POPULATION

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SCIENTIFIC INVESTIGATION OF
POPULATION PROBLEMS

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A SURVEY OF THE PROBLEMS OF POPULATION

By THE EDITOR

ENUMERATION OF CHANGE

Measured and unmeasured changes continually take place as time goes on. Each day the units of population grow older; the imperceptible changes of a day measure in a ten years' span our changed physique and altered economic place. While some depart each day, recruits arrive to swell the population. Population is in constant flux. Our first concern is with these dynamic conditions; our problem is to gauge these annual changes. At what rate and at what interval is the grave replenished from the cradle?

We cannot, unfortunately, take a count of the number of living persons at a given instant of time in the world. The area of inhabited land is vast and living conditions vary in different regions. A completely accurate enumeration of the world's population is an unrealizable ideal. Counts taking place in countries that have an organized Census system are likely to be reasonably accurate, but even these are only considered necessary at comparatively infrequent intervals, such as ten years. From them we do get information of a definite character, giving facts about population at the particular time when the Census took place. For some countries we must rely upon estimates. In others births and deaths are systematically registered, and these records, together with cognate facts obtained during the Census, give us the data from which to solve the first problem of population: what is the quantitative rate of change?

CHANGING RATES OF GROWTH

Careful study of these elementary facts has revealed for many countries what some consider rather an alarming state of affairs: the fact that over a period of years the rate at which population is replenished has been steadily diminishing. In England and Wales there were 26 million persons in 1881 and the number of births was just under 900,000. In 1921 the population was 38 millions, but the number of births was less than in 1881, about 850,000. In 1931 the population was 40 millions and the births 630,000. There is a considerably smaller number of births now to a population which was increased by 14 millions in 50 years. The picture is even less pleasing when it is visualized in terms of rates. To every 1,000 persons living in England and Wales 50 years ago there were 34 births, to every 1,000 to-day

there are about 15 or 16. These facts relating to this country are found repeated in many other countries of similar economic and social structure.

CONDITIONING FACTORS

What has happened? This is another of the problems of population. Is this persistent decline in the birth-rate a reflex of the economic and social philosophy obtaining in the country exhibiting the symptom? Is it connected with the community-life of the people? Is the family changing its structure? Did males and females marry in the past for the purpose of founding a family, and do they now marry with other objects in view? A consideration of these aspects of the problem leads to investigations in which different races are compared and contrasted. It leads to the facts ascertained for one country being compared with those of another, regard being paid to the different geographical features and economic life of the two regions. Concern is felt for the differences between urban and rural life in the same country in relation to population distribution. Thus in some investigations the unit considered may be the individual, in others the family, and in others the unit may be the whole community. But the problem is always: the ascertained facts point to changes having taken place over a period of time, to what causes may these changes be attributed?

QUANTITATIVE AND QUALITATIVE DISTINCTIONS

Much attention is paid to the individual differences between units of the population. In a count each person is given the same cipher value. Thus, in a total population of 25 millions a Prime Minister contributes 1 unit, equivalent in value to the unit representing the year-old infant which may end its life in a home for mental defectives. As in the comparative calculation of the relative military strength of two nations account must be taken of their effective and non-effective personnel liable for military service, so, in a comparison of the populations of two countries at the same date, or of the same population at two different dates, attention must be paid to the quality of the population. Thus, emphasis is placed by some investigators upon the greater importance, for the economic and social structure, of half a million births of sound physical stock than twice that number of births which includes a high ratio of congenital defectiveness. Ignoring

qualitative discriminations, other investigators confine themselves to quantitative problems, maintaining by implication that at birth one child is of equal value with another.

DIFFERENTIAL SURVIVAL

Qualitative problems have received a considerable amount of attention in recent years, partly on account of the significance of changes also observed to be taking place in the differential death-rate. In England and Wales over half a million deaths were recorded in 1881, giving a death-rate of 20 per thousand of the population, whereas in 1931 the number of deaths was just under half a million, a rate of 12 per thousand. This change in the death-rate is attributed to advances in medical knowledge and practice, and to improved sanitary services. In the same period of 50 years the Infantile Mortality Rate has been halved. Thus, we may say that there are many persons alive to-day who, had they been born 50 years earlier, would probably not have survived to the age they have now attained. There are many young children who now survive their most difficult first year of life, owing to the attention paid by public opinion and Medical Health authorities to the prevention and control of disease, who, half a century ago, would not have lived long. Some social workers contend that many of the lives so saved to posterity by improvements in hygiene and medical practice become an economic charge on the rest of the community, owing to their unfortunate lack of those attributes which are necessary to the healthily functioning individual. The plea is put forward that those of sounder stock who can command greater material comforts than others, contribute so much to the commonwealth, which subsidizes the support of the unfortunate dependents upon it, that they are prevented by that economic burden from contributing their quota to the new generation. It is shown that there is a differential fertility rate as well as a differential survival rate, that the better-off physically and those higher in the economic scale contribute relatively fewer offspring to the future population than the constitutionally weaker and those in the lower economic grades. The contention that this tendency leads to "race-suicide" is put forward by the advocates of the medical supervision of contraception. The old blind trust in Mother Nature is disappearing. The idea that she automatically regulated the size of the population without conscious human assistance, but by pestilence, famines, and wars is

no longer current. The newer ideas of control, regulating the size and quality of population in conformity with current needs, have grown. The methods and efficacy of this control, the discussion of the needs of the population from different points of view, and the problem of the kind of population most satisfactory in the light of the knowledge of these needs are the concern of many investigators.

APPLIED STATISTICS

In discussions of investigations of population, statistical data are necessarily analysed in order to diagnose tendencies emerging from established records, to demonstrate the present structure of population in simple terms and to prognosticate the future course of population, given the continuance of already observed determining factors. Thus we have tables showing that in some countries the population is gradually getting older owing to the declining birth- and death-rates; that soon the population will become stationary and may eventually decline. These facts and speculations naturally have a bearing on the activities of legislators and public officials planning for the future needs of the population, in such directions as the provision of school accommodation, water supply, sewage disposal, housing, etc. If the time comes when the population of European races declines, will there be a transference of surplus populations from the East, China and Japan? Problems of migration are obviously problems of population.

TEAM WORK

Some investigators are concerned with the discovery of a "law" of growth of population: a law which can be expressed in simple mathematical language. Experiments are made in the laboratory of growth changes in communities of living units in carefully defined universes, where variations are made in environment, food supply, and so on. Thus the biologist enters into the field. He also concerns himself with changes in fecundity and fertility in response to variations in the environment. The biologist is concerned with organic changes in the unit of population and how these effect changes in the total population. The anthropologist, by considering civilized as well as primitive populations, investigates their social structure and customs and throws light on aspects of population which are otherwise not noticed.

The importance of these problems led to a World Population Conference at Geneva in 1927, after which an International Union for the Scientific Investigation of Population Problems was formed. The *Proceedings* of the Second General Assembly of this Union held in London in 1931 are published under the title of "Problems of Population," edited by the General Secretary, Mr. Pitt-Rivers. This volume of proceedings in effect gives an answer to the question, "What are the Problems of Population?" In the volume are papers read by many distinguished persons of different nationalities, with discussions which took place at the meetings. Therein each authority gives his views on different problems, and, in effect, practically the whole range of these studies comes under review. In 1932 the Executive Committee of the Union decided to start a Journal to be devoted to the study of Problems of Population, the title of the Journal to be POPULATION. This is the first number of the new Journal.

THE URGENCY OF POPULATION STUDY FROM THE BIO-ANTHROPOLOGICAL APPROACH*

By G. H. L. F. PITT-RIVERS, B.Sc.(Oxon.)

(*Hon. General Secretary International Population Union, and Chairman British Population Committee*)

INTRODUCTORY

The science of population is vast in scope and intricate in its complexities. It is perhaps misleading to speak of *The* Population Problem, for the laws of population growth and distribution are not reducible to any one simple formula.

The organized study of the science of population on an international basis is of recent origin. The first World Population Congress was held at Geneva in 1927. Twenty-seven countries were represented by eminent specialists in the departments of biology, genetics, economics, anthropology, and geography. Following on this Congress an International Union for the Scientific Study of Population Problems, known shortly as the International Population Union, was formed in the following year with adhering National Population Research Committees in twelve of the leading countries of the world, and three International Research Commissions were organized to prosecute researches touching the special problems of each country and groups of problems that have to be studied internationally by a specialist technique. Among such specialist problems are those dealing with food supply and agriculture, migration, growth of population, fertility and sterility, distribution and employment of population, mortality and morbidity, hybridization and the mixing of races, and the study of depopulation among vanishing races.

All population problems thus have two aspects—a domestic and an international one. It may further be claimed that few domestic or international problems in the economic and political spheres, in which scientific method still needs to be applied, are not essentially related to the laws of population growth and distribution.

I must content myself with a brief reference to some aspects of these problems that concern us most closely and which have perhaps also been most neglected.

* This article sets out the scope, and discusses the subject-matter, of "human ecology" or "ethnogenics." A proposal to inaugurate a Fourth International Research Commission covering this ground was adopted by the Executive Committee in October 1932. Biologists and anthropologists are invited to contribute in working out a programme for research.

Beyond an insistence upon the fundamental importance of the ubject and the need for a rigorous scientific method in approach-ig it, we are, as a scientific institution, united by no solitary octrine of interpretation. Particularly when it comes to seeking olutions we need not all find ourselves in the same camp.

We are familiar with the apparent paradox of poverty amidst lenty, of the cheapening of, and increase in, production accom-anying a decrease in the consumption rate and purchasing power f the rapidly expanding populations of Europe and America. Vhile a certain political bias must inevitably sway the ideal of vhat all students of human affairs may hope to bring about, we, s students of the science of population, set ourselves the task f first discovering and diagnosing the facts. The fundamental aws underlying these facts, and the application of those laws y discovering what the future is likely to bring, must assuredly e of prime interest and importance to us all; whether our present ommitments are planned on an expectation of future develop-nents and opportunities in industry or trade, whether we look head for some assurance of continuous employment at a stable vage and an expectation of a retiring pension, or whether we re convinced by the prospects of maintaining or improving the resent standard of living.

In short, we are concerned whether we are primarily absorbed y the problems of what *should* be and what we hope will be, or whether we are primarily concerned with what *is* and what nevitably *will* be.

While the older Malthusian controversy appeared to present he problem almost exclusively in terms of density in relation to food supply, we now better appreciate that the effects of over-population and of under-population may co-exist among com-munities in close contact, or in adjoining areas, and these opposite effects may even be detected by various criteria among different strata of society within the same area.

OPTIMUM DENSITIES

Our preoccupation with the sociological problem may encourage us to see the first consequences of an expansion beyond optimum density in a gradual breakdown in organization, with reactions upon the control of society and, in the economic sphere, upon its distributive capacity. Thus we may endeavour to show in various ways that an economically unabsorbed or unabsorbable

population may and does exist at the same time as over-production and in a world producing a food surplus.

We therefore arrive at the conception of an optimum, or most favourable, density of population relative to the total situation. The total situation comprises the standard of living obtaining in any country, and is relative to the means of exploiting physical power, the fertility of the land, and the extent of its dependence upon its surplus resources in providing an exchange for the commodities and services it needs in the other countries with which it trades.

OPTIMUM DENSITY AND OCCUPATIONAL DENSITIES

It is, of course, obvious that density increases only by an excess of births over deaths, and that a very high birth-rate accompanying an equally high death-rate will not affect total density. It is equally a truism, even if less obvious, that human fecundity is normally so much greater than the maximum fertility compatible with the means of subsistence that, in all populations that are maintaining themselves, natality compensates mortality. In Darwin's formula, "Fecundity is in direct relation to the chances of death." In other words, in all populations there exist checks, or factors, limiting the rate of growth short of the maximum rate that human fecundity makes possible. These checks are represented by the total elimination rate. Actually no population has been known to maintain its maximum growth-rate of any one period continuously. At the same time, while the food supply may not in itself become an operative check limiting density in any one region, every population would eventually, if it increased indefinitely, exhaust the maximum productivity of the region it inhabits. Thus it must eventually either become stationary or decline for that or other reasons, or it must draw its subsistence from wider areas by extending its markets, or by migrating to them, until they in turn become exhausted (*note 1*). Sometimes the rate of growth unevenly distributed between rural and urban areas may outstrip the capacity for occupational absorption. This has tended to happen in Australia, where natural increase together with immigration and an internal rural-urban drift has resulted in occupational congestion and unemployment in the cities together with a dearth of workers on the land. Rates of population growth and distribution are observed in this way to be influenced by economic and social structure. But occupa-

ional congestion or the over-manning of certain occupations is usually balanced by under-manning in others; just as regional over-population and under-population are compensatory phenomena, often occurring together in the same country at the same time.

All occupations become increasingly interdependent with the progress in industrial organization and complexity. This occurs as much under one political system as another. A differential birth and survival rate is the biological factor tending to disturb the occupational balance. The clearest examples of disturbance in occupational balance are to be studied in the countries where the neglect of agriculture for industry contributes towards its major economic difficulties, and tends towards too great urban with too small rural densities.

In speaking of the optimum density for any one country or population, we must therefore insist on the interdependence of that standard we speak of as the optimum with the distribution of internal densities, as well as external densities of populations in the same economic system.

The optimum density, therefore, for a whole country at any one time is to be represented by a mean to be determined after adding the surplus urban to the rural shortage of population.

The most favourable regional density will again largely depend on the optimum occupational density wherein man-power is balanced by the natural resources and the technical means at the disposal of the community for developing them, and for exploiting physical power in relation to the needs and capacity for consumption in the producing region and in all other regions with which it trades. Thus rural density in India, with a much smaller density of population per square kilometre than Great Britain (in 1921 it was 68 in India to 189 in Great Britain), became over-populated long before England did, judged by the symptoms of over-density in famine and epidemics, high mortality rate, low longevity, and actual food shortage. The food shortage in India is said to equal about one-third the amount required; the standard *per capita* food consumption in pounds being less than one-third the *per capita* food consumption in the United States. Calculated at 741 pounds in India (Madras) to 2,664 pounds in the United States of America (*note2*). In agricultural productivity India stands very low in the world scale with an index number of 85 compared with Belgium's 221. All these facts serve to emphasize India's

lack of growth in productive power in proportion to her increase in population; her rate of population growth has outstripped her means of production. In England the problem is different in that her productive power and her native population have increased in response to the needs or demands of the populations to which she exports her commodities, and these have changed, leaving her productivity unrelated to the needs of her native population. The increase and growth cycle of population in England was therefore in no way dependent upon the development of primary production which was consequently neglected. Over-population may thus occur even in a decreasing population. The population that our native resources could be made to support is very much greater than the proportion of our population the land actually does support. While we either are or *could be* self-supporting as regards certain kinds of food such as fresh milk, it was calculated by Sir Henry Rew in 1912 that we then produced about one-half of our essential foods, with the exception of a few things like sugar and cocoa, and about one-half in terms of energy value (*note 3*). In respect of wheat, on the other hand, before the War we only produced 20 per cent. of our requirements. In 1918 we produced about one-third of our requirements, when the wheat acreage (2,797,000 acres out of total cultivated area of 31,748,000) was the largest since 1882.

THE URBAN-RURAL BALANCE

In respect of both agricultural productivity and employment, and consequently, it is necessary to insist, of rural density of population, England can support and employ a much smaller population per acre of potentially similar arable and pasture land than a country like Germany. This difference is largely conditioned by politically controllable economic adjustments in taxation, death duties, and first charges on land, which have increasingly tended to make agricultural production unremunerative. By the use of nitrogenous compounds alone it has been calculated that 70 people per unit could be fed against an existing 40 (*note 4*). That is to say, whereas the German farmer fed from 70 to 75 persons per 100 acres, the British farmer fed from 45 to 50. British and Belgian land, which greatly resembles it in natural fertility, give a calculated comparative productivity of 19 against 80. The German yield per acre doubled in the 30 years

before 1918, while that country imported about ten times as much Chilean nitrate as the United Kingdom.

Thus optimum density is conditioned by the rate of growth in relation to occupational distribution, particularly in the balance between urban-industrial and agricultural occupations, and to regional changes in density. We have so far considered only the possibilities of defining the optimum density of a country, and its relation to differential regional densities, and to occupational congestion, with its bearing upon overseas markets and population conditions in those countries with which it trades. We have not dealt with the more difficult problem of the effective causes producing or influencing disturbances in the growth and balance of internal groups in a country's population. These factors are both various and interrelated, and may be conveniently distinguished as biological, social, and economic. In actual fact they cannot satisfactorily be studied apart.

From the biological approach we are concerned with the relative fertility and survival rate of differentiated groups and classes composing the population of a nation. Thus viewed it becomes a part of the fundamental problem in evolutionary biology, that of variations in adaptation. A population does not survive by replenishing its numbers equally from all its composite groups. It changes in composition, numbers, and quality. It changes in respect to the proportion of sexes and of age groups, while many different factors tend to bring about these changes. Quantitative changes bring about qualitative changes. It is well established, also, that the amount of food is by no means the only factor, nor necessarily an operative factor, regulating numbers, but a change in any one factor must bring about changes in all the other factors linked or connected with it. Thus changes in the average age of marriage of either sex, and postponement of the marriage age, which either economic or biological factors—such as disturbances in the sex ratio (*note 5*)—may help to cause, will in their turn, if affecting different groups unevenly, bring about differences and changes in the relative fertility of occupational, economic, or social groups.

The relation between economic status and fertility has been widely studied in different countries. It is characteristic of recent researches in highly industrialized countries that women with relatively higher weekly family incomes tend to have fewer pregnancies and fewer children than those women with

relatively lower weekly incomes (*note 6*). In so far as economic factors alone are involved these researches suggest that the fertility of the wealthier and productive classes tends to become increasingly susceptible to economic pressure. As the discrepancy in numbers increases between the self-supporting and productive classes and those more or less dependent on State subsidies, economic pressure on the dwindling self-supporting class is in itself exaggerated. In England complete family endowment is reserved for those drawing Poor Relief or unemployment insurance doles.

ANIMAL POPULATIONS

It may be as well, also, to insist that optimum densities exist not only for human populations, but for animal populations as well, and are not only to be measured in economic terms, but also in biological terms. For instance, Professor F. A. E. Crew has demonstrated experimentally that mice segregated in a confined area cannot survive beyond certain and variable limits of population density, irrespective of an abundance and surplus of food, or irrespective of factors of morbidity. The results obtained, which support the conclusions of other workers experimenting with other animal populations* that the death-rate, reproductive rate, and fecundity of a population are affected by density, also suggest that the individuals comprising a population are not equally able to adapt themselves to the same conditions of density, and that increasing density beyond a generally supportable level tends to eliminate those less adaptable to it.

Density, therefore, is a factor, of course amongst other factors, operating selectively in a population influencing the death-rate, reproductive rate, and fecundity, from which may be calculated normality according to individuals capable of surviving and reproducing in different densities.

Generally speaking, the study of Jewish demography shows that Jewish populations are capable of surviving and maintaining their numbers in congested urban industrial areas much more favourably than non-Jewish groups in the same countries.

The science of population not only deals with the technique of foretelling population trends and establishing optimum densities,

* Dr. R. Pearl has shown that fertility decreases and the death-rate increases with density of population in Drosophila and in fowl populations.

but aims at elucidating the causal factors producing the over- or under-population that exists in different parts of the world.

POPULATION GROWTH CONDITIONS ECONOMIC PROBLEMS

Behind the total economic situation, and conditioning it, lie the laws of population growth. Physical science and technical efficiency promoted the rapid development of industrial expansion culminating, during the later nineteenth century, in the final establishment of the doctrine of prosperity as measured by increasing markets for increasing production of exports and surpluses. This led to industrial planning based on continuity in existing trends in production, consumption, and population. The logical consequence of this doctrine was the policy of cheapening production costs by increasing plant and machinery, doubling and ever redoubling output and reducing labour. A further consequence of the triumph of the industrial doctrine was the neglect of agriculture and the sacrifice of the home market in favour of an expanding export market, on which we in England depended for feeding the greatly increased population that our industrial progress brought into being. For more than half a century our exporting industries have been planned in confident anticipation of continuity in the rate of expansion of markets and production, which ultimately implies a continuous and indefinite increase in the consumption rate of population and its buying capacity. Calculations based on present trends indicate that in about seven years' time the population of this country will have reached its maximum, by 1951 it should have declined to the 1931 figures, and should thereafter decline more rapidly.* By that time the problem of economic absorption will have become intensified by a distribution in the age classes, which will show a much greater proportion of men and women over the age of sixty. We shall have become an older population, and the pensionable proportion will be greater relatively to the self-supporting and the productive. Failing a true diagnosis of the causal factors in the total situation relating to the human material, based on an understanding of the laws of growth, saturation, absorption, and "optimum density" of population, any remedies proposed are likely to be aggravators of the causes that produce the evils.

* Assuming a relative consistency in birth-rate, death-rate, and migration trends. Cf. Professor A. L. Bowley, "Economic Aspects of the Tendency of Population," *Proceedings*, Problems of Population, 1932.

THE APPLIED PROBLEMS OF POPULATION

Having examined the nature of the problems of population, we should be in a better position to discover the facts and to determine their meaning in terms either economic or biological; and, in planning our future course or actions, in political terms.

We should be better prepared to reply to the questions:—

> What do we mean by over-population?
>
> In present conditions is England over-populated?
>
> What would be, under present conditions, an optimum density for England?
>
> How does population pressure show itself?
>
> Is unemployment a sign of over-population?
>
> To what extent is the standard of living in England dependent upon overseas trade?
>
> In what way do forecasts of future population affect industrial planning, and to what extent will the development of native resources and employment be affected by its growth or decline?

We have recently heard a great deal about original economic theorists who advocate a complete departure from traditional economic standards of price-level, production, and currency. In America one of their theories has been announced under the forbidding title of "Technocracy." Mr. G. D. H. Cole, Major Douglas, and Mr. Orage are among those in this country whose views appear to be similar. They appear to make common ground in declaring that over-production is impossible, and that its appearance is due solely to faults in distribution. It is impossible for me to discuss at length these theories, beyond the suggestion that they ignore the dependence of production upon the numbers and quality of producers in relation to the numbers and quality of consumers. In short, they ignore the problems of the functional and biological structure of human populations. By implication over-production of the human material is assumed to be as impossible as the over-production of human commodities, as they also forget that the functional and organic structure of human society determines real wealth, which is based ultimately not on commodities or the power to produce commodities, but on functional service and the social demand and need for service. The economic structure of society functions in reciprocal service,

and service produces commodities or administers to human needs.

Let us now consider some of the facts of population growth in England and Wales in relation to occupation and production.

England may be distinguished from every other country in the world by the extent to which her population depends upon industry and commerce, in contrast to agriculture and primary produce, for its existence and the rapidity of its growth.

Of her total occupied population (1921) 6·8 per cent. are engaged in Agriculture and Fishing, against 60·6 per cent. engaged in Industry, Trade, Transport, and Mining. At the other end of the scale in the Soviet Union of Russia (1926) 86·7 per cent. are engaged in Agriculture and Fishing, and 9·1 per cent. are engaged in Industry, Trade, and Transport. In Germany, France, Sweden, Denmark, and some other countries the balance is intermediate. England is less capable of provisioning herself than any other country in the world.

From 1851, the year in which England may be said to have established her industrial supremacy, this country strove increasingly to become an industrialized State living by the export of its manufactures. Consequently it adopted an economic policy and philosophy which became, during half a century, as unquestionably rigid as religious dogma, depending for its apparent validity upon an uninterrupted expansion of overseas markets and the ever continuous promise of finding new ones.

While the balance of overseas trade and the easily amassed fortunes of an increasing army of large industrialists were complacently accepted as the sole rod measures and standards of national prosperity, the real foundation and source of all wealth and happiness, which lies in the health, the quality, and the productive capacity of the raw material of industry—the population itself—was already presenting problems, ignored and never inquired into, which grew in urgency as time went on. The idea that saturation point could ever be reached, either in density and the economic absorption of population, or in the eventual limits in the capacity of markets for the consumption of goods, barely entered into the heads of any of the political or economic pundits of the nineteenth century. Consequently, so far as any of them stopped to recognize the existence of any biological or physiological factors at work behind their fantasy world of "economic facts," they were content to hail with joy any rise in the birth-rate which might ensure the continuous flow of new hands into

their new factories for the production of new goods for new lands without end.

With the progress of industrialism changes were also taking place in the composition and distribution of population; in the balance between the productive and dependent, between the birth-rate and the death-rate, between the healthy and sickly; between the proportion of men and the proportion of women, and between the rural and urban populations, which eventually affected costs of production and the burdens in the form of taxation upon it which helped to disturb the equilibrium between consumption and production.

The industrial machine, becoming ever more complex, has brought in the train of that revolution a vast increase of population which it finds increasingly difficult to absorb profitably or healthily. The progress in technical efficiency in the development of machinery has outrun efficiency in control and organization of the human material whose labour it absorbs. The increasing use of machinery has tended to reduce the amount of labour needed to man the machines, with the consequence that the increased output of machine-made goods finds a decreasing human market for them.

England and Wales contain a population of some 40 millions, with a density of 671 people to the square mile (the comparative density of the United States of America is 39).

In the five years between 1906 and 1911 the population of England and Wales increased annually at the rate of 1·04 per cent., at which rate the population would double itself, if maintained, in sixty-seven years. Of course it is not maintaining that rate. The annual rate of increase in 1928 was by 190,000, by 1938 it will have decreased to an annual rate of increase of 110,000, and between 1940 and 1945 should have ceased altogether.

The total inhabitants of the country (England and Wales) in 1750 are given as 6,300,000 (Gonner). Fifty years later, at the Census of 1801, the population was 8,900,000, an increase of over 40 per cent., and in 1850 we had a population of about 18,000,000. At about that time we first became dependent upon overseas sources for our food supply. Since then the population (now 40,000,000) has increased 130 per cent.

The decennial increase per cent. during the second decade of the nineteenth century (1811–1821) was as high as 18·1, by 1911–1921 the per centum increase had dropped to 4·9.

ETHNOGENICS. THE STUDY OF RACE POPULATION CULTURE IN EVOLUTION

We have seen that the study of human populations touches on a great variety of cognate subjects. It touches on biology, anthropology, agriculture, statistics, economics, geography, migration, genetics, and sociology; and in its applications it must inevitably have important bearings upon politics—the organization and control of human societies. In the widest sense of the term anthropology embraces all these interrelated subjects, for the anthropologist is concerned to study and analyse how human communities function. He must study the individual man in his relation to society, and his place as a unit of a group or class functioning in a composite whole. In doing so he is studying the problem of adaptation—of change and survival. We have considered some evidence for the view that density in itself is a factor capable of causing maladaptation, which is a selective process bringing about changes in the types that survive, upon rates of growth and fertility. In short, the study of man in relation to his environment involves also the study of change and numbers.

ECOLOGY

The biological study of plants, and more recently of animals, paved the way for a more systematic study of the changes in species and individuals due to environmental influences. Ecology became, in fact, an embracing science which had for its field the adaptive relations between plants or animals and their environment.

It became apparent that the mechanism of the control of numbers of any given species depends on its relation to other species which are its enemies or parasites, or its prey. A serious disturbance affecting the optimum number of one species will affect the optimum number of every other species linked to it in the economy of the region they inhabit. Disturbances in numbers come about in many ways, through epidemics, the failure of food plants causing famine, or by a sudden increase in numbers caused by a decrease of the various checks normally in operation.

In the organic world any failure in adaptation is reflected in some change in numbers or the balance and distribution of numbers between one population and another. An excess in one region or

in one species must find its compensation in the increase or decrease of another (*note 7*).

EPIDEMIOLOGY

Many diseases and epidemics are caused by the sudden increase of a species.

Density is only one of many changing factors capable of disturbing the adaptive equilibrium between an organism and its environment. Obviously, when whole races decline or die out as they are doing, notably in some parts of the Pacific, where land and food are abundant, pressure of population is not a factor which produces their decreasing fertility. It is therefore only by ignoring the part that density may play in the total complex of environmental factors conditioning adaptation, that some writers generalize in the following way: "In circumstances of ease, the birth-rate tends to fall; in circumstances of hardship the birth-rate tends to rise" (*note 8*). This is simply not true, and no student of the problems of depopulation could well be guilty of the statement (*note 9*). Such apparent plausibility as it possesses is due to a faulty diagnosis of the phenomena of an increasing population accompanying a slowing up in the general birth-rate when a certain degree of density has been reached and while increasing density is still associated with increasing wealth. It is coloured by the observation in countries having a differential birth-rate that, at certain periods of increasing density, economic pressure is so distributed that the struggle to maintain a higher standard of living becomes first reflected in a lowered birth-rate among the wealthier and economically more vulnerable classes.

Now, an examination of population tendencies in the Pacific and elsewhere appears to show that people are far less adaptable to great and sudden changes in culture-form than is generally supposed. The more specialized a people become through segregation and the agency of selection, the more closely adapted are they to the culture-forms they have evolved. Any drastic change in mode of living and in culture-form imposed upon them from outside and not evolved or modified by themselves leaves them, for this reason, ill-adapted to the innovation. It is a psycho-physical problem, the physical consequences of which are illustrated in the phenomenon of the gradual extinction of unadapted peoples. This conclusion is supported by an analysis of the demography of peoples all over the Pacific and in America,

where a biological substitution of population is taking place. Apart from a systematic analysis, however, the facts are apt to be obscured by the gradual infiltration of foreign blood into a declining population, and the frequent inability to discriminate between the unadaptable and unmixed stock that is declining and the new miscegenated stock which is capable of surviving under the changed conditions.

OVER-POPULATION AND DEPOPULATION

In every instance where one culture strongly influences another, a condition of culture disequilibrium is engendered, followed by the extinction or modification of the weaker culture and a variable degree of readaptation accompanied by a greater or lesser change in ethnos (*note 10*).

When two races meet there are three ways by which one may extinguish the other. Directly, by violence; secondly, by gradual substitution through differential birth and survival rates; and, thirdly, when they mix freely, by selective elimination of less adaptable characters. We often confuse the decline of a race and the decline of a population. The infiltration of alien stock may check the decline of population, while, at the same time, the racial elements continue to decline.

But the cultural clash resulting from one racial group dominating another does not always initiate a state of depopulation, it may promote the opposite. India provides an instance. Here the opposite of depopulation is occurring. Whether it amounts to over-population or not has already been discussed.

We appreciate that the study of man in his environment differs in scope though not in method from the study of animal ecology principally by the fact that *culture* is a conditioning factor in man's environment. Culture, incidentally, covers the study of every aspect of what is called sociology, including economics. It is necessarily also one of the principal variable factors influencing density, distribution, and migration of populations. Thus comes into being the science of *human ecology*, the study of ethnic units in evolution conditioned by the total factors of the environment, including, naturally, cultural factors. It becomes the study of race-population-culture in change, for which I propose the title "Ethnogenics" (*note 11*). The problem of miscegenation is thereby included.

We too readily become aware of any sudden or dramatic

changes that from time to time may punctuate the slow evolutionary course of man's age-long history, while we too readily fail to note the revolutions brought about by the constant flux that marks the time process, and ignore the far-reaching and cumulative consequences of a gradual process.

Only by a technique and discipline that solves the aetiology of our changing life can we hope to measure, however tentatively, the shadow of the world's proximate future, or be equipped to control its course.

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AN OUTLINE OF POPULATION HISTORY

By Professor A. M. CARR-SAUNDERS*

It is only with the most recent times that we have accurate figures for the population of any country. Of early times there are only two things that we can say with any certainty. The population was very sparse, and the changes were in the nature of fluctuations in density rather than of increase or decrease. How sparse the population was in early times and under primitive conditions may be gathered from the fact that the estimate for the population of Canada at the time of the discovery of America is about 150,000. In other words, there were then about as many inhabitants as there are now pure-blooded Indians in that country. There must have been considerable fluctuations owing to famines, wars, and other disturbances. But net growth was so slow as to be imperceptible.

It is impossible to form any estimate for the population of the world before the seventeenth century. A very carefully considered estimate for the year 1650 gives a total of 465 millions. The population of the world is now a little less than 1,900 millions. There has been a fourfold increase in the population of the earth in 300 years—a fraction of the length of time that the human race has existed. We may be sure that the historian of the future, however remote, will remember this epoch for one characteristic at least—the great outpouring of people. It is this epoch alone that we can study in any detail, and it is to the outline of events in this period that I wish to draw attention, because if we explain these events we can get close to the understanding of population phenomena.

The materials for this study are very incomplete. The taking of censuses began little more than 100 years ago. At present about two-thirds of the population of the world is periodically enumerated. China, which probably contains a fifth of the human race, still has no reliable census. Estimates for the population of that country differ by over 100 millions. Thus figures for the population of the world at the present day are liable to a considerable margin of error. As we go back in time we must rely more and more on guesses, and about the middle of the seventeenth century material even for guesses fails us. But beginning from that date it is possible to reconstruct the outline

* Part of a Discussion on Population before Section D of the British Association, 1931.

of the story. Professor Willcox of Cornell University has subjected all the evidence to a most careful scrutiny, and in what follows I am going to make use of his figures and desire to acknowledge my indebtedness to him.

It is impossible to give any indication here of the nature of the material upon which the estimates are based. I may perhaps be allowed to say I was engaged upon an estimate of the population of the world in 1750, and had arrived at a figure which I employed in lectures when Professor Willcox published his work. My estimate differed by only 40 millions from his. While this fact proves nothing, it may be taken as some indication that the material is not of such a nature that any figure can be supported from it. Let me first attempt to summarize this result of using this material which will pave the way for an attempt to answer certain questions which are of great interest, namely, where the outburst of population began, and to what degree the various continents and races of mankind have shared in it. Professor Willcox gives 465 millions as the total world population in 1650. At that time, and in fact until 150 years ago, the proportion of the population of the world found in America and in Australasia was negligible, about 3 per cent. In 1650 just over half was in Asia and just under a quarter in Europe and Africa respectively. Asia had about 250 millions, and Europe and Africa about 100 millions each. For 1750 the figure is 660 millions. That is an increase of over 40 per cent. in 100 years. It is quite clear that increase at anything like this rate was not in progress before. The great outpouring had begun. Africa did not contribute to it. Europe was increasing. About that there is no doubt. The estimate gives a 40 per cent. increase for Europe. But it seems that Asia was moving faster; according to the estimate the increase in Asia in this period was about 60 per cent. On this showing Asia took a leading part. There was so little intercourse between Europe and Asia at that time that the two forward movements must have been quite independent. The fact, if it can be established, is of some considerable interest, and I shall return to the point later.

Between 1750 and 1800 there was an increase in the rate of growth, and the population of the world rose from about 660 millions to about 840 millions. During these 50 years both Europe and Asia seem to have increased about 30 per cent. By 1850 the population of the world had passed the 1,000 million mark, and was about 1,100 millions. But during that half-century the rate

of increase was higher in Europe than in Asia, approximately 40 per cent. as compared with 30 per cent. Europe had gained a lead over Asia, which it has retained to the present time. The most rapid rate of increase, however, came during this half-century, to be shown by America and Australasia, and their populations begin to form an appreciable fraction of the world's total. Africa did not begin to move forward until after 1850. The population of the world which was then about 1,100 millions is now between 18 and 19 hundred millions. Before analysing these estimates it may be as well to emphasize their speculative nature. I do not think, however, that the speculations are baseless, and I find support for this in the fact that two wholly independent estimates agreed in all essentials.

Accepting these estimates as worth some attention, it appears that the proportion which the inhabitants of each continent form of the world's total has not changed much. Asia begins and ends with just over half. Europe begins with a fifth and ends with a quarter. Africa's share has declined from 20 per cent. to 8 per cent. America and Australasia have come in to make up the total, contributing 13 per cent.

Returning now to the origin of this rapid forward movement, there is no doubt that it must be placed in the seventeenth and early eighteenth centuries. There is no dispute about that so far as Europe is concerned. It would seem that there was a similar movement in Asia, perhaps beginning earlier and progressing for a time at a more rapid rate. This is very much more doubtful. But it seems difficult to resist the conclusion that there was an independent forward movement in Asia, though it may not have been of the magnitude that the figures given suggest. The matter well deserves more research.

This fact, if established, is surprising. During the last 150 years there has been an impact of Europe upon other parts of the world. We know in some detail the nature and results of that impact upon the populations of, say, Java and Japan. The immense outburst of population in those countries in the last century was clearly due to the results direct and indirect of that contact. In a similar fashion India has added 30 millions to her population in the last decade. It is quite clear, in other words, that forces released in Europe in the eighteenth century were carried to other countries and produced there also an increase in numbers. The problem is whether there was not an independent movement of perhaps

slightly earlier date in Asia. We may perhaps remember that there was an outburst of population in one European country, namely Ireland, which was of greater proportionate magnitude than any which occurred elsewhere in Europe, and which owed nothing to these forces. What caused these events in Ireland is obscure, but it is at least possible that similar causes may have been at work in Asia and have produced similar results.

So far I have spoken only of continents and their inhabitants. If we now ask what has been the fate of the various races of mankind during this movement, the answer in broad outline would seem to be as follows. The primitive races, including all those up to the level of the highest American Indians and Africans south of the equator, kept on the even tenor of their way until they came into contact with Europe. The result of this contact upon races at this level was everywhere disastrous at first. Numbers declined heavily. Some races vanished, the Tasmanians, for example. Among others the decline has not been arrested—the Australians and some Polynesians and Melanesians. But most of them recovered after a time and began again to increase. The increase has in many cases not only enabled them to recover lost ground, but to exceed their former totals. The best estimates for the population of America before the discovery do not exceed 10 millions. A low estimate for the number of pure-blooded Indians in America at the present day is 13 millions. The Africans south of the equator probably declined throughout the nineteenth century, though not the population of Africa as a whole, because Egypt and other North African countries were on the increase. The Africans are now showing signs of following in the steps of the American Indians. We can sum up the result so far as the primitive races are concerned by saying that they have about maintained their absolute numbers, though they have lost relatively.

What is the position in regard to races above this level? This demands an examination of the fate that has befallen the Europeans. The great multiplication of mankind has been accompanied by a migration of Europeans on a vast scale, but not of other races. It is remarkable that the vast increase in the populations of China, India, and Japan in the last 300 years have led to so little movement of their inhabitants. But though the migration of Europeans has been on a vast scale from the geographical point of view, almost exactly three-quarters of those of pure

European stock are living in Europe to-day. There are about 640 million persons of unmixed European descent, and of them 478 millions are found in Europe. The outflow of Europeans has meant the political subjection of a great part of the world to Europe. But if permanent ownership of land is only to be had by cultivating it, and there is much to be said for that view, it must be doubtful how much of the territories falling to Europeans in the last 300 years will turn out to afford new permanent homes for them.

But putting that speculation aside, we can use the figures for Europeans of pure blood to ascertain the changes in the proportions which Europeans and Asiatics form respectively of the world's total. The result is to show that 300 years ago the Asiatics formed 54 per cent., and now form 52 per cent., whereas the Europeans then formed 21 per cent., and now form 28 per cent. The changes in the proportion which the various races form of the total as a result of the great multiplication is less than might have been expected.

These tremendous events aroused very little interest at the time. Men became aware that the population of the world was increasing rapidly. The obvious fact that it could not go on at that rate indefinitely excited no apprehension. Then voices were raised prophesying disaster. The panic-mongers failed to observe that the situation had changed and changed fundamentally. Within the last 50 years the birth-rate has declined among almost every people of European descent. Among some the decline has been so sharp that the population is not reproducing itself. That is the case in Great Britain. Among others the population is just reproducing itself. That is the case with the United States of America. Among the rest there is hardly a case in which the first steps have not been taken. All races of European descent are treading the same path, though at different intervals of distance. The most noticeable feature of the position is that there is no connection between the decline in the birth-rate and either geographical position or stage of economic development. The connection is with a certain type of civilization and culture.

There is hardly any exception to the fact that the decline in the birth-rate is confined to races of European descent. I exclude the case of the certain peoples in Australasia, because it is quite obviously a feature of the impact of Europe upon a primitive civilization that I have mentioned, and has nothing to do with

the modern phenomenon. The division between the high and low birth-rate peoples is sharp and becoming sharper; the former at present include Russia. It may be asked how the decline in the birth-rate has affected the rate of increase of Europeans and non-Europeans. The answer is that up to the present the rate of increase of the Europeans has probably not fallen below 1 per cent. per annum, since for a variety of reasons the decline in the birth-rate takes time to make itself felt. The rate of increase among non-Europeans can hardly amount to more than 0·5 per cent. per annum. Since Europeans form about a third of the total population of the world, it may be that the annual increase of Europeans amounts to about the same figure as that of non-Europeans.

But this will not continue. Races of European descent will cease to increase within, say, two generations. What will happen to the rest? Most authorities believe that there has been no increase in the population of China during the last 80 years, or perhaps for an even longer period. There have, of course, been great fluctuations. The population has not increased because the country can hold no more people as things are. To that point India, Japan, and Java are coming. It looks as though Europe would cease to increase, because, in spite of a very low death-rate, the birth-rate is so low, and that the same result will be reached in the other countries, because, in spite of a very high birth-rate, the death-rate will be so high.

This is the shortest possible sketch about that period of population history about which we have some knowledge. The task of filling in the details has hardly yet begun. It will never be possible to carry the story much farther back. It may be possible to reconstruct the course of events for some short periods and certain places at earlier dates. But the history of the last 300 years must remain the chief material for investigation. The next task is to account for what has happened. Biological factors have no doubt played a large part. For the sake of clarity it seems desirable to distinguish between those cases in which biological factors have operated independently of other factors, and those cases in which biological factors have been brought into operation through other changes. Professor Gini has recently propounded the view that the decline in the birth-rate is due to a sort of senescence. I mention this view not because I believe that it has any foundation, but because if it was true it would be an example of a biological factor

acting so to say independently. Then there are those cases in which biological factors have come into operation through the medium of other changes. If it is true that bodily exercise influences the reproductive functions and therefore the chances of conception, then such revolutions in habits as the introduction of games into schools would be a case falling under this head. If it is true that the use of soap affects the reproductive mechanism, we should have another example. Such cases shade off into those in which biology only plays a part in a remote sense. In so far as men abstain from marrying or marry later, and thus reduce the birth-rate, the only factor of importance is a social factor. It is to the disentangling of these factors as contributing to the bringing about of the events that I have sketched that research must be concerned.

A SURVEY OF DATA RESPECTING ANIMAL POPULATIONS

By Professor JULIAN HUXLEY*

(1) *The Genesis of Population.*—This, of course, includes the various aspects in which reproduction may be studied—Fecundity, Fertility, and the habits of Mating related to these phenomena.

(2) *Maintenance.*—The persistence of a population clearly entails a study of ecology—that is, the conditions in which the population exists, including its food supply. The quantitive aspect becomes of importance here, and depends upon the balance between the reproduction rate and the conditions of the environment, including enemies of every type. The periodic fluctuations in numbers studied by Elton (see later) are of importance here. These, however, are not universal. Two very stable animal populations may be mentioned: (*a*) the beaver, which guards against food shortage by storing; (*b*) the elephant, which has practically no enemies.

(3) The quality of the population, which to some extent depends on the factors already enumerated, brings in another function of the environment, namely, selection. In animal populations—indeed, in populations of any organism living in the natural state—an evolutionary trend would be the result, in so far as the variability of any given population is acted upon by selection.

(4) One of the most obvious points in the life of progressively higher types of animals is the increasing care of the young, which lowers the need for high fecundity. A comparison may be made between the rodents, which have several numerous litters in the year; the larger carnivores, with two or three young born once in the year; and elephants with one calf in three years. The tendency observable in the natural state is towards a stability established by the interaction of the various factors in the bionomic situation already mentioned. Dr. Elton, in his extensive work on this subject, has drawn attention to two methods of the establishment of this stability: (*a*) constant fluctuations relatively small in extent round a given mean (so long as the environmental conditions remain unchanged), or (*b*) a cyclic type of variation. This latter has been clearly established in many forms, e.g. in Canada, in the populations of the lynx and the snowshoe rabbit. As with

* Part of a Discussion on Population before Section D of the British Association, 1931.

most herbivores, under favourable food conditions there is with the rabbit a great increase of both fecundity and fertility, this increase evidently outstripping the predatory capacity of the enemies, namely, the lynx, and leading to over-population. This in its turn is checked by epidemic disease, which causes such a high mortality as to bring the population down once more to its lowest level. It has been shown that the Canadian snowshoe rabbit in unfavourable conditions may produce only a fifth of the normal number of offspring. Periodic fluctuations on this scale certainly do not occur in man.

(5) Amongst some herbivores this phenomenon of over-population may lead to migration, the best-known example being that of the lemmings in Scandinavia. Another of the well-known cases of migration is that of the locusts, the devastating swarms being apparently due to an immense numerical increase under unusually favourable conditions of food supply till over-population causes the swarming.

The numerical fluctuations of the herbivores are followed, with a slight lag, by similar increases and drops in the population of the carnivores. In general it may be said that, in nature, as with man, migrations afford only temporary relief.

(6) The selective influences acting on population have been shown by Sewell Wright to vary with different sizes of population. In a small population selection may gradually change the character of the whole group, while in very large populations selection tends to act on different variations giving rise to local races.

(7) Next it will be necessary to consider the differences between animal and human populations. Man by new inventions alters the possible maximum population. Further, the conception of an optimum population, that is, the most favourable density, is just beginning to be studied with care. Man has certain powers of adjustment (some of which may not always be of a desirable type). We remember in Europe a tremendous drop in population following the Black Death, and again after the period of the Thirty Years War.

Secondly, it should be observed that man's control of his environment makes possible a decrease in infant mortality and in the incidence of diseases which would decimate the adult population. In certain eras the lowering of the birth-rate brings about a great change in age distribution in a population, a phenomenon which is unknown amongst animals.

Thirdly, as against the definite sex cycle of most other mammals, man has the capacity of breeding throughout the year. As Dr. Zuckermann has shown, however, this is only the continuation of an evolutionary trend of this nature already found in monkeys and apes.

Fourthly, it has been stated that domestication is a causal agency in extending the breeding season. But this is true of certain animals only, such as the cow, pig, and rat; it has not occurred in the sheep and horse, which have a very long history of domestication.

A population thus depends on inherent fecundity balanced by natural selection (i.e. successful defences against enemies), length of life, etc. In man the innate primitive fecundity is highly excessive for keeping up a stable population, or even for securing a reasonable increase. Human migrations have been very great in extent, but have only delayed the problem of over-population by a few generations, without solving it.

The human fecundity range is a constant one as against the fluctuating numbers already mentioned in the snowshoe rabbit. Nevertheless, there are great individual human variations in fertility running from complete sterility to families of twenty and over. There is thus more intense selection in man on the character of fertility, or any characters which happen to be associated with it, than amongst animals, and hence the differential birth-rate occurring is of vastly greater importance in his case.

(8) Man never exerts his reproductive capacity to the full. All peoples show, and have shown, some type of population control, beginning with infanticide and abortion amongst primitive peoples. In civilized man such control takes the form of deferred marriage, of long periods of abstinence, of abortion—which exists to a much greater extent than is usually recognized—and of birth control. The age of migration is passing, as most of the more empty countries are closing their doors, and when we look at the impossibility of any considerable extension in such saturated areas as India, China, and Belgium, we are faced with the fact that the world is filling up. The offset made possible by birth control becomes a point of the first magnitude. It is apparent that the death-rate cannot fall very much farther, but the birth-rate might theoretically fall to zero. Wherever there is no birth control there will be an outward population pressure which clearly indicates the danger of war.

In some countries over-population is an urgent problem; in others it is more than likely that rapid population decrease will prove equally urgent. We need to devise methods for the regulation of human numbers.

(9) Sanitation and hygiene have in man greatly reduced the action of selection. Studies in the laboratory give the impression that most new mutations are deleterious, and hence it is equally clear that some method of scientific selection is urgently needed. The differential birth-rate points in the same direction. It is regrettable that the censuses of 1921 and 1931 were not so framed as to give clear data on the differential birth-rate as did that of 1911. The Ministry of Health of the future will require more scientific methods.

Dr. R. A. Fisher has presented this subject very clearly in his recent book, *The Genetical Basis of Natural Selection*. He lays stress on the fact first noted by Galton in his study of the families of heiresses, of the inheritance of low fecundity, and proceeds to show that high fertility (apart from the State-supported family) is an economic disability tending to prevent rise in the social and economic scale. Thus our present social system is selecting out its more intelligent types, not only by bringing them into the region of the lowest birth-rate, but by coupling genetic factors for low fertility and for success. This is actually contra-selection, and in one chapter Dr. Fisher makes a very good case for such a process as the real cause of the decline and fall of former civilizations. He goes on to propose the remedy of family allowances, graded in ratio to earnings of man, as a scientific remedy for this condition.

THE BIOLOGICAL ASPECTS OF MIGRATION*

By Professor F. A. E. CREW

Man is but one of many animal types whose relative interest is largely determined by their convenience as material in biological investigation; we are persuaded that though the human subject is indeed remarkable in that he differs more or less markedly from all other animals, he is even more remarkable in that in a hundred ways he and they are alike. We approach this subject of population fully aware of the probability that many of the phenomena exhibited by a human community will be found characteristically in populations of other and widely differing animal groups. Though we are not prepared to turn to the ant, or even to the lily of the field for examples of correct human social behaviour, we are not unwilling to turn to the rabbit in our attempts to gain a proper understanding of the origin and destiny of empires.

We have been taught by the natural historians that in that most variable of environments, the wild, population problems exist, and that these problems are regularly solved: that the numbers of animals in a given limited area bear a demonstrable orderly relationship to the conditions of that region. The numbers of animals in a given region are subject to large and frequent fluctuations. Since the agencies and conditions which permit and encourage the inherent tendency to numerical increase, and also those which cause reduction in numbers, vary considerably from time to time and from place to place, the numbers of any given form of animal life in any region also vary from time to time. But, on the whole, at most times and in most places the number present in an area is that which is, according to our view, most appropriate to the conditions existing in that region at that time.

This harmony is not restricted merely to the numbers of animals: it extends also to the types of animal life found in any given region. It can be stated that, in general, in any given area which can be defined in terms of its capacities to support animal life, there will be found those animal forms which can exist and flourish therein, and, moreover, these will be present in numbers which are in accord with the conditions of that area. If the habitat is described, the ecologist, theoretically, can list the animals which

* Part of a Discussion on Population before Section D of the British Association, 1931.

will be found there, and can form an estimate of their numbers. State the animal and the ecologist can describe the habitat.

This essential harmony between the animal type and number and the conditions of the habitat is destroyed if the capacity of the habitat to support a particular type of animal life depreciates temporarily or otherwise, or if there is disproportionate growth of the animal population. The disharmony caused by the disproportionate population growth of any particular species inhabiting a given region is removed by one of several methods—an increased death-rate, a reduced fertility rate, and migration. I propose to deal only with the last of these methods.

It has been shown that animals do not stay in one place, but that they move about, and that in this movement they seem to exhibit the ability to choose or reject the conditions in which, in so moving, they find themselves. The ecologist is forced to postulate the existence in animals of an ability to choose an environment appropriate to their needs, or, as Elton has it, animals exhibit a definite awareness of inharmonious relationship with the environment.

Reasons have been adduced to show that this widespread tendency to migrate under certain circumstances is an inherent impulse, which drives animals from conditions which the human observer can only describe as conditions of discomfort, or of danger, to some other and more agreeable environment. We are permitted to hold the view that if in a given area and in relation to the existing conditions in that area there are too many animals of a kind, the surplus is commonly removed by migration. We know that all do not leave, but we do not know in what ways those who stay differ from those who leave: we can only surmise that those who leave react to the stimulus of discomfort more thoroughly than do those who stay. In a general way it can be said that the migrants seek another sparsely populated habitat, the conditions of which are not too dissimilar from those of the old.

Though it is most necessary and exceedingly difficult to avoid anthromorphism, teleology, and other pitfalls which so abundantly await the too earnest seeker after biological truth in the wild, it surely is reasonable to glean from studies of animal populations the following notions:—

1. Between the size of a population and the conditions of its habitat there is a harmonious relationship.

2. If this harmony is destroyed by disproportionate population

growth, then the migratory impulse may be released. A population includes those who, under certain conditions, migrate, and those who, under the same conditions, do not. The intensity of the migratory urge exhibited in response to a given environmental stimulus is not the same in all.

3. Migrants so select their new habitat that its conditions are in harmony with their needs.

4. If the conditions of the new habitat differ from those of the old, they may serve as selective agencies which may encourage the appearance and perpetuation of segregated genetic variants and discourage the persistence of the original phenotype.

5. In any given habitat there are to be found the appropriate numbers of the different animal types that are in biological harmony with each other and with the conditions of the habitat.

Against this background of our knowledge relating to animal populations it is profitable to examine those problems which can be shown to have their origin in the growth and movement of human populations. It would seem, indeed, that this migratory impulse is as inherent in man as it is in other animals. It would seem that commonly when the human population of a political unit or geographical region changes the conditions of its habitat—for example, when a previously agricultural organization gives way to an industrialized, urbanized society, or a malevolent feudalism is replaced by a democracy, so that between the new conditions and many of the biological types a disharmony is created—sections of the population exhibit this urge to swarm in an attempt to restore the essential harmony between themselves and their habitat. In other cases, phenomenal increases in the capacity of a habitat to support animal life seem to have encouraged great increases in population size, and these, over-topping the increase in resources, or the facilities for their distribution, have provoked migration. It was toward the end of the eighteenth and during the beginning of the nineteenth centuries that the Anglo-Saxons swarmed in this way. Large migratory movements to the Americas, to Australia, South Africa, and numerous other parts of the globe took place, and the types that migrated were colonists and not exploiters of new habitats. Many other peoples had swarmed before this; some are swarming to-day; others will swarm in the future.

I wish to suggest that human migration is a biological phenomenon that has been exhibited by a great number and variety

of human stocks; that migration has a meaning in biological philosophy; and that, therefore, in any political discussion relating to migration, certain biological principles have to be recognized.

It may be assumed that man, like animals, leave one habitat for another because the latter offers, or appears to offer, more congenial conditions. Manifestly, the discomforts which release the urge to emigrate and the comforts which invite immigration differ widely from species to species and from type to type within a species. In the case of man, occupational considerations are commonly of more urgent importance than any question as to whether or not the individual or the type are so biologically constituted that he or it is in discord with the old conditions and will harmonize with the new. It can be said that migration occurs only when the promise of the new habitat is preferable to the experience of the old, or when the conditions of the old are so unbearable as to make even perilous escape preferable to staying therein. But only when an individual migrates to a new country for biological reasons can it be said that such migration is really profitable to the species.

The political theory known as Imperialism comes into being whenever migrants from one habitat have colonized others, but inevitably it refers not only to colonies but also to regions which are not colonized but merely exploited. To the biologist, all Empires are alike in this, and a study of our own is a study of all. When the phase of migration on the part of the Western European peoples had passed, they possessed, politically, almost every part of the world that was sparsely populated and that could be colonized or exploited. The distinction between colonization and exploitation is really a biological one. Animal populations, in migrating, select harmonious habitats which they colonize, but man in his migrations has settled in regions, the conditions of which are so unlike those of the habitat in which he had his origin, that with them he was not, and could never hope to be, compatible. Commonly, he has selected his new environment, not for its fitness, but for its fatness—its financial fatness. Migrants from temperate zones, biological types fashioned by a peculiar habitat—and type and habitat are so intimately interrelated that one cannot discuss the one without reference to the other—have settled in tropical and subtropical regions which demand an entirely different type of man, and therefore a different type

of social structure, if there is to be harmony, and harmony there must be if man is to flourish racially.

There is no doubt that man can, to some considerable extent, control the conditions of his environment, but to the biologist this does not mean merely that man imposes upon the forces of the environment modifications advantageous to himself: it means also and equally that man in his functionings adapts himself to the conditions of the environment. To this adaptation there are definite limits. All individuals and all types of mankind are not equipped with equal powers of adaptation to marked and varied differences in environmental circumstance.

It is doubtful that pure bred British stocks can ever claim to be in biological harmony with habitats outside the temperate zone. No doubt they can exist in most places, but to live fully, to reproduce freely, to develop and to function smoothly, they must be where they belong, in a habitat that biologically belongs to them. From the political point of view, our presence in those parts of the Empire where conditions prevail to which we Britons can probably not ever hope to adapt ourselves is interpreted as meaning that we are there, not for our own benefit, but for the good of the indigenous native, and to me, as a biologist, this attitude is significant. As is our custom, we have made a delightful political virtue out of a biological necessity.

If there is truth in the view that a human stock cannot claim as its own any habitat in relation to which it is biologically unfit, that biological fitness is the only valid title to a territory, then in formulating our reasonable expectations concerning the further history of our empire we must bear it in mind. If, for example, there are habitable regions in Australia still untenanted, if these regions lie within the tropics, and if men of Anglo-Saxon stock cannot colonize them whilst others can claim a biological harmony with them, then it is to be expected that sooner or later the type that can only exploit will give place to the type that can colonize, for the tropics belong to those human types which can make for themselves permanent homes therein. The argument that five Japanese or ten Chinamen can live well on the needs of one Australian, and that therefore the Australian should give place to them is one that we, as biologists, may well leave to the parties concerned: its biological aspects are too obscured. So long as the Australian can claim to be in harmony with those parts of Australia which he inhabits, so long can he claim the territory. But

if and when it can be shown that there are regions of Australia that cannot be colonized by Australians, but which can effectively be colonized by Italians, or Japanese, or Chinese, the biologist, in his capacity as biologist, must agree that the latter have the prior right to these regions.

Vast areas in East Africa are presently being exploited by white men who cannot colonize them. Under the conditions which obtain there the white cannot compete, reproductively or economically, with the migrants from India. India is now exhibiting the phase of migration, and there is only one region where the migrants can find a new habitat with agreeable conditions and sparsely populated, and this is East Africa. I am not at all concerned with political considerations, but to me, a biologist, it seems that nothing is more certain than that no purely political attitude can continue to withstand the inevitable fact that a habitat will sooner or later be the possession of the biologically most appropriate stock. It seems to be true that the admission of a more suitable biological type into a given habitat held by a less appropriate biological type means sooner or later the expulsion or extinction of the latter, and the attitude of the white toward the brown is understandable. The question is: can it prevail?

South Africa's greatest problem is the same; it is not whether the Dutch are biologically more in harmony with the conditions of the country than are the British, but whether either of them or the black races can compare with the Indian in their fitness for this particular environment.

The Chinese are swarming and are conquering in their peaceful migrations vast regions in the Pacific. This migration is an event which surpasses in importance all the civil wars that are now being prosecuted in China, for we are being given evidence that of all the human stocks the Chinese are perhaps the most adaptable —they seem to breed and to develop normally anywhere and everywhere. If this is the case, then indeed they will inherit the earth. It is not the Chinaman's meekness that makes him so formidable: it is his adaptability.

The claim of the Northern European to North America and New Zealand is entirely warranted on biological grounds, for there he thrives amazingly. In these habitats he found sparse populations of human stocks no more appropriate to them than his own; his stock replaced theirs, and his filled, or is rapidly filling these regions.

It seems to me that we have to accept the fact that just as we and other peoples swarmed years ago, so now the Indians, the Japanese, and the Chinese, for the same reason that they, as we, are animals who, under certain circumstances, exhibit characteristic reactions, are exhibiting this migratory urge. But whereas in our time there was ample room, nowadays there are political barriers to migration everywhere. There is no reason to assume that this phase of migration is an indication of racial strength, or that having passed beyond it, a race is heading towards decay, since it is probable that this migratory impulse is always released by the appropriate stimulus, and that without this there is no response. We are not migrating, not because we are racially senile, but because we are socially comfortable.

Unless we can prevent the causes that lead up to migration, we cannot prevent migration, and in the case of Indians, Japanese, and Chinese the causes have already operated. What can be done? I do not know. If this problem is created by the operation of biological factors, then it must be solved through the control of these factors. Even if, for reasons of political vanity, of financial gain, or of biological necessity, a population gains additional and suitable territory, the problem is not solved: its final solution is merely postponed. The only real solution is that a population living in an appropriate habitat shall so fashion the conditions of this habitat that they will be as "comfortable" as possible to all the various biological types in the population; and that the reproductive rate of the population as a whole and of its component types shall be so controlled that the numbers of a population are in constant accord with the environmental opportunities for their support.

In the case of human populations it seems to be commonly the case that environmental discomfort is associated with a high reproductive rate and with the exhibition of the migratory urge; whilst associated with environmental comfort there is a low reproductive rate and no migration. If this is so, then migration will continue to complicate international affairs so long as the environments of certain populations remain harsh. Improve their habitats and migration will cease.

But this is a slow process, and in the meantime, since we cannot impose compulsory birth control upon our surging competitors and upon subject races for our own political ends, I suppose we shall be pushed out of those

imperial territories which we cannot colonize by such races as can.

I have suggested that the conditions of a new habitat may encourage the appearance and persistence of new genetic variants. If this be so, then it may be expected that in time colonists may come to differ from their ancestral stocks. This seems to be happening in certain cases, although it is impossible as yet to distinguish between non-inherited personal adaptation and true genetic dissimilarity.

One last point: though in all probability not everyone from this country could live and thrive in any and every part of the Empire, yet, in view of the fact that we, like all others, are a very mixed people and include a considerable number and variety of biological types, it is not improbable that amongst our people there are sufficient numbers of every type to suit every one of the different environments that in their combination constitute the Empire. Perhaps the time will come when the emigrant will be advised, after a complete physiological examination, that he should seek a particular habitat rather than go, as he now does, to that part of the Empire which in its advertisements seems to offer him the most rapid financial gain. We are quite aware of the fact that of the emigrants that leave our shores all are not successful in the regions to which they go. I suggest that it is not unlikely that in many cases this is because the choice of a new habitat is commonly made without reference to the biological requirements of the individuals concerned. If the psychologists can tell us what trade or profession we should follow, it is the biologist who will tell us where we should follow it.

A BRIEF REVIEW OF THE PRESENT POPULATION SITUATION IN SOUTH AND EAST ASIA*

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INTRODUCTION

Most people are very well aware that the densest large masses of humanity are to be found in southern and eastern Asia. I say densest "large" masses, because actually the densest population is to be found in England, which has well over one person to the acre ($1\frac{1}{7}$). But if we consider larger areas, we shall find no numbers to compare with these of India and China. And if we deal with still larger regions and take southern and eastern Asia, so as to include not only India and China, but Indo-China, Japan, Java, Sumatra, and the East Indian Islands and the Philippines, we shall embrace a land area of somewhat over $5\frac{1}{2}$ millions of square miles and a population of about 890 millions, so that, on an average, there are about 157 persons to the square mile, whereas the average for the whole world is about 38. In this space we find mankind packed four times as tightly as the average.

It may be as well, perhaps, to glance for a moment at the world average. If we exclude the arctic regions, the area of the rest of the land surface of the globe is about 50 million square miles, an easy number to remember. So far as mere space is concerned, that gives us a limit which we cannot step over; in this we include deserts, the great forest regions such as those of the Amazon and the Congo, and the inhospitable sub-arctic lands—in fact, all regions which may conceivably be made available for human habitation. But, of course, mere area is a very poor guide to such availability. If, as an example, we compare the areas of Australia and the United States, we shall find them much the same; whilst the habitability is, perhaps, something like one to six, or in these terms. Still, with these conditions in our minds, there is no harm in looking at the world area as a whole, for it will serve to remind us that there is a limit, and that infinite space is not at our disposal. Of the total space available, Asia and the two Americas each account for about 16 million square miles, Africa for over 11 millions, and Europe for a beggarly 4.

* Being the substance of a lecture delivered before the Royal Asiatic Society, London, on December 8, 1932.

It may be noted that the area of Africa is about the same as that of the entire surface of the moon.

What is the human population of the whole world? The latest detailed investigation of this question was made by Mr. W. F. Willcox, in Volume II of *International Migrations*, 1931. Taking 342 millions as the population of China, he calculates that the number for the whole world was, in the year 1929, 1,827 millions. Now this figure must be corrected, first for the three years that have passed since 1929, and secondly for the very unexpectedly large increase in the Indian population, as revealed in the Census of 1931. Making allowance for these, it would appear that the world has now about 1,891 millions of human beings on its surface; or, as we really do not know within 10 millions or more what the figure is, we may say 1,900 millions at the present moment. Of this total it was calculated, three years ago, that 642 millions were of unmixed European stock, so that there would be some 660 millions of that stock now (1932).

It follows from the above figures that the average number of people per square mile, over the entire habitable land surface, is about 38, or, say, in round numbers 40; and that is very nearly the average density of the United States. Compare England's 742. It also follows that the portion of the globe that we are now considering has nearly half the population of the world on a land area of about one-ninth of the total. What is the main reason for this disproportion? Perhaps, as regards the two main areas, namely India and China, the chief reason is the antiquity of the civilizations in large, relatively fertile regions; and we may, if we like, picture a standard of living in these countries, gradually improving, but very slowly, from dim antiquity; this standard having in comparatively recent times to contend against the pressure produced by the increase of numbers, so that there is less food to go round, and so that, bit by bit, the inhabitants live a less happy life, until in large districts a state of what Europeans would consider semi-starvation becomes the rule.

Such a mental picture at once brings to the mind the idea of an optimum density, an idea about which much has been written. Under given geographical conditions, taking the term in its widest sense, we may suppose that there is a certain density of humanity which will produce or maintain a race in a state of greater moral, mental, and physical fitness than will other densities, either above or below the optimum. We are not here concerned

with improvement by mixture of races, or with Petrie's very attractive theory that the complete crossing of two races produces the maximum of ability, and that from the point of maximum ability repeated generations diminish in efficiency. Those interested in that ingenious speculation will no doubt have read the admirable article on "Historical Cycles," by Mr. O. G. S. Crawford, in *Antiquity* for March 1931.

No, we are here concerned with a much simpler notion. We suppose that the racial mixture remains the same; that the race, or races, in a given region are confined to that region; that the geographical conditions do not change, and in that wide term we include conditions subject to the hand of man. It is, then, only common sense that there is some low density which will not allow the benefits of nature to be properly utilized; just as there is some high density which outstrips the power of nature to supply the mass adequately with the reasonable comforts of life. It is a commonplace that in former times, with large birth-rates, the growth of humanity was checked by war, pestilence, and famine. Nowadays the human race is beginning to take thought for its own future and to think of the possibility of providing less cruel checks on the growth of numbers; such forethought will be increasingly necessary as the improvements in medical practice and sanitation result, as they have already resulted in Europe, in largely diminished natural death-rates.

There is another general consideration that should just be glanced at. It is possible to imagine a population which should be, so far as total numbers are concerned, an optimum population, and yet the result might be anything but happy. The internal structure might be unbalanced, and this might happen in various ways. One very well-known condition is that in which the age structure is, so to speak, top-heavy; there are too many old people. This will result when an excessively large population tends to become stationary and finally to diminish.

But there is another kind of unbalanced structure, namely, that which results from an unsuitable distribution of professions and occupations. Thus it would be possible to imagine a population in which some excessively large percentage were dentists, mostly out of work, and mostly not adaptable to other professions. In a small way something of the kind seems to be happening in the medical profession. It is reported in the newspapers that, in America, the number of medical graduates has so increased in

the last ten years, that the annual increase now exceeds by 50 per cent. the average annual loss by death. I do not know what truth there is in this statement. But a much more serious fact has been called attention to by various students of these questions, notably by Mr. Harold Cox. He points out that in our present population structure in Great Britain there is an excessively large proportion of poor people who are dependent on manual labour for a living. He says, in a letter to *The Times* of November 10, 1932, that the machines of to-day have in many industries displaced the manual worker. But the poorer classes continue to increase in numbers and to seek for employment which they cannot find, and as a result there is a large population unable to support itself. It would be possible, as an agreeable theoretical exercise, to work out an ideal occupational structure for any given country, having regard to existing conditions. Public and private efforts might be directed towards an attempt to reach such a structure. This might ultimately result in something like a caste system of an improved kind. But, indeed, a caste system, as regards professions, almost exists in England now. Look at the number of lawyers' sons who become lawyers; or doctors' sons who become doctors; or miners' sons who become miners; or soldiers' sons who become soldiers, and so on. It is not a bad system, given always the power and the opportunity for the exceptional person to break loose.

Mutatis mutandis, the same general considerations apply to Asia. The absence of war, pestilence, and famine, and the unduly high birth-rate, have made of India an unhappy breeding-ground, and the same remark may apply to China, where the high birth-rate operates in spite of war, pestilence, and famine. The high birth-rate is, no doubt, in the main, due to a special philosophy which encourages breeding without consideration of the happiness and fitness of those who are bred. But it cannot be long before even the races in those two countries begin to look to fitness, rather than numbers, as the test of human responsibility.

CHINA

There can be no really accurate estimate of the total population of the world so long as we are in our present state of uncertainty about the population of China. Various calculations of this figure have been made, but none can pretend to be very reliable. Then there is the question as to what we mean by China. There are

those who would, for instance, exclude Outer Mongolia and, perhaps, Manchuria. As regards the latter, the population in 1900 has been stated to have been about 14 millions; in 1927 it is supposed to have been over 24 millions; and now, in 1932, it was probably 30 millions. This very rapid rise is, of course, due to Chinese immigration. Professor Roxby remarks (*Scottish Geographical Magazine*, March 1930), that, "as a purely agricultural country Manchuria can almost certainly support 50 millions at a higher standard of comfort than prevails in rural China as a whole," and, in view of its probable industrial development, he thinks that the country could support an even larger population.

The same authority, in a paper in the *Geographical Review* for January 1925, estimated the total population of China, including Manchuria, as about 400 millions.

But the latest, and probably the most reliable, estimate is that of Mr. W. F. Wilcox, in the second volume of *International Migrations*, published in 1931 at the cost of the Social Science Research Council of the United States. He points out that in 1910 there was an official return of the number of households, but it is not certain who were included in the household. There was a second return in the following year, but this was left unfinished on account of the revolution. He gives reasons, based upon the return of 1910, for adopting a value of 342 millions, and he compares this with two other estimates, namely, that of the China Continuation Committee of 1922, which was 375 millions, and an estimate of A. Supan in *Die Bevölkerung der Erde*, which was 330 millions.

Mr. Willcox then takes 342 millions as the most probable value of the population of China, including Manchuria, and we cannot do better than follow his example. Without Manchuria the number will be about 312 millions; at least, that would have been the number in 1930, and, in view of the disturbed state of China, we may as well accept it as being still the most probable.

Having cleared the ground as to the total number of inhabitants of China, let us now inquire into the character of the pressure that this mass of humanity exerts on individuals, and the main results. China proper, excluding Manchuria, has an area of about $1\frac{1}{2}$ million square miles, with an average density of 200 persons to the square mile. This figure may be compared with the present average in India proper of 215, or in Japan of 450. But in such a

great and varied area an average has but little meaning, and the picture alters much as we turn to the different geographical regions of which that area is composed. The province of Kiangsu, for instance, has a density, per square mile, of over 800; whereas Yunnan, bordering on Burma, has a mean density of only 64. But in the latter province, if we distinguish between the hill regions and the restricted valleys, we find that the former have about 40 to the square mile and the latter some 400.

Whatever may be the state of the western and south-western provinces, there can be no doubt about the pressure of humanity in the low-lying river and coastal regions. Professor Roxby remarks that: "It is unquestionably true that certain regions of China are supersaturated and show unmistakable symptoms of over-population, a standard of comfort below that of the Orient, a basis of life so insecure that any temporary failure of crops . . . is almost immediately followed by famine on a large scale . . . and a constant tendency even in good times for the overflow of population." If this is the case, where does the population flow to? The answer is that, in the first instance, it overflows abroad: to Indo-China, Burma, Malaya, and elsewhere. Dr. Ferenczi, who wrote the first volume of *International Migrations*, on behalf of the International Labour Office, remarks that "Long before the nineteenth century the teeming population of the Chinese provinces poured over into neighbouring Asiatic countries, and during the last century this tendency was accentuated." It seems probable that the number of Chinese living abroad is now some 10 millions. In British Malaya alone there are 1,700,000.

But the surplus population of the denser regions also expands into the outer provinces, and of this Manchuria affords the most striking example. It has been calculated that in the three years 1927–29 Manchuria absorbed 2 millions of Chinese, though the rate was somewhat checked in the latter year. The total increase from 1900 to the present day is very great. A year ago Mr. Yoshizawa, the Japanese Ambassador to France, stated that the development of Manchuria under Japanese enterprise had resulted in 25 years in an increase of population from half a million to 30 millions—almost all Chinese it may be said. And this is in a country about twice the size of Germany.

It will be interesting to see whether, under the new political conditions, there will be any considerable immigration of Japanese, for it has usually been held that the Japanese are not prepared

to work in Manchuria under the same hard conditions that the Chinese are accustomed to. It is usually stated that owing to their higher standard of living they cannot compete with the Chinese as colonists in that country. But things may change.

The Chinese from the over-populated regions are also pressing into the four provinces of Inner Mongolia, and also into the provinces of the south-west, Kwei-chow, Yunnan, and the southern half of Szechwan. There is great racial similarity between the Shans of western Yunnan and the Shans of Burma. Professor Roxby (*Scottish Geographical Magazine*, March 1930) says that the Chinese are colonizing the uplands and are leaving the valleys to the Shans. The south-west "is becoming an essential part of the Chinese cultural area." Looking at the Chinese population situation as a whole, it is evident that emigration has, in recent years, been on so large a scale that it has probably afforded some real relief to the over-crowded areas. It must also be borne in mind that, apart from these areas, China, including Inner Mongolia, is in a partially developed state, and that the population, though excessively dense in some provinces, has not the great density of India, and still less of Japan. But the prevailing disorder and lack of good government entirely prevent the organization of measures of development which might relieve the pressure. And, if it ever comes about that a strong humanitarian central government were to take in hand the question of the distribution of the population, it would seem that the first matter to be considered should be the improvement of the very low existing standard of living.

Birth-rates, death-rates, standards of living, measures of development, and emigration, are all linked together. But with a high birth-rate, and a tendency to pile up to a miserable degree of discomfort, perhaps the main factor is the standard of living. This affects the moral, mental, and physical condition of the people. It does not take very long before one reaches the idea that population questions cannot be discussed without reference to the quality of the masses under consideration.

On the political side the pressure of population in the over-crowded regions of China has no very marked bearing at present, except in Manchuria. Eventually the existence of a huge Chinese population in Malaya may raise some questions. And it is much to be hoped that the admirable indigenous culture of Burma may not, in the end, be swamped by Chinese emigration.

JAPAN

There are two groups of islands, on the outskirts of two continents, which have a kind of general similarity to each other. They are the British Isles and Japan. Their areas, in thousands of square miles, are 120 and 147 respectively. They are both in the temperate zone, though Japan approaches most nearly to the tropics in the south, and is in the sub-arctic zone in the north. They have somewhat similar mean annual temperatures; but the extreme range of temperature is, of course, greater in the case of Japan. Mr. Walter Weston writes to me: "The length of the stretch of Japan, north and south, is seldom realized unless one has travelled or studied it closely, as in the Kuriles it reaches not so very far from the Arctic—at any rate it is sub-arctic. And yet even in mid-Japan, Tokyo is on the same latitude as Malta and Gibraltar; but the other day I heard from a friend of quite a heavy fall of snow there. On the west coast, in the same latitude, I have visited villages which in summer are unbearably hot, though literally buried in snow in the winter. Some of the mountain regions in the main 'Alpine' ranges are extraordinarily wild and desolate. One prospect I had from a mountain summit in 36° N., about 10,000 feet, disclosed almost 1,000 square miles of practically uninhabited and uncultivated, because uncultivable, land."

Mr. W. R. Crocker, in his excellent book which was published in 1931, on *The Japanese Population Problem*, remarks that in Japan proper "Humanity is pent up in thick density on the flats and valley bottoms, and the rest of the country is left over to the wilderness of the forest-clad ranges." Practically all the available arable land is made use of; the land is, in fact, subjected to the most intensive cultivation.

The density of population of the British Isles, including Ireland, is over 400 to the square mile, and of Japan about 450. If we consider the density of population of Great Britain only we shall find it to be over 500 to the square mile; just as if we consider the population density of England alone we shall find this to be over 740 to the square mile. In the same way, in the case of Japan, if we exclude Hokkaido, the northern islands of Japan proper, relatively cold and unfertile, the density of the rest is nearly 550, and there are large areas where the density considerably exceeds this.

According to the *Japan Year Book*, if the density per square

mile of cultivated area is the basis of comparison, this works out much higher than in any European country; being more than twice that of Belgium, three times that of Italy, and four times that of England. The implication being, of course, that Japan is relatively deficient in cultivated (and cultivable) land.

It is clear that Japan must be classed as one of the most densely populated countries of the world, comparable with Great Britain and Italy; the latter being not dissimilar in size, with an area of 120,000 square miles, a population of 42 millions, and a density of about 350. In this connection one might also mention Java, that very heavily populated island, with an area of about 50,000 square miles (nearly that of England), and a density of more than 700 to the square mile. The reasons for such a high figure are that Java is a fertile, tropical island, with industrious inhabitants who have a relatively low standard of living.

From figures kindly furnished by the Japanese Consul-General, it appears that the census taken on October 1, 1930, shows the following results for the Japanese Empire:—

Japan proper	64,447,724
Korea	21,057,969
Formosa	4,594,161
Sagalien	295,187
Total	90,395,041

The total population of the Japanese Empire in 1925 was 83,456,929, and in 1920 was 76,988,379. The five-yearly increments being 7·47 and 6·94 millions, a decreasing sequence.

The population of Japan proper has been:—

In 1920	55·963 millions
„ 1925	59·736 „
„ 1930	64·447 „

The increments for the five-yearly periods are: 3·773 and 4·711, an increasing sequence. The percentage increases were 6·7 and 7·9; the percentage increase per annum being now about 1·6, and the annual increase being about 942,000. If the tendency to increase continues, in a short time the absolute annual addition to the population of Japan will be a million. The increase of population in recent years has not been entirely a natural increase, that is, one due to excess of births over deaths, for it has been stated that since the annexation of Korea more than a million Koreans have emigrated to Japan, more than counterbalancing

the movement of Japanese to Korea. This tremendous expansion of numbers is to be traced in the main to the opening of the country to the influences of Western ideas in the fifties of the last century. Until that period the population increased but slowly, being about 26 millions in 1723, and about 27 millions in 1846. But in 1872 the census showed a total of over 33 millions, and that figure is now (1932) doubled, i.e. the population has doubled in 60 years. As was the case with this country, the industrial revolution has been a principal cause of the increase, though it must be noted that Miss M. C. Buer attributes a large share in the population increase in Great Britain to a fall in the infantile death-rate.

In spite of this enormous increase no considerable emigration has yet taken place from Japan, and present-day emigration is almost negligible. Writing in 1922, Dr. Hatoyama calculated that, in 1920, the total effect of the Japanese emigration was that there were 649,000 Japanese outside Japan proper. Another estimate for 1926 gave the total number of Japanese living abroad as 640,000. The Japanese Consul-General gives the following figures for emigration: in 1928, 19,850; and in 1929, 25,704. These figures are small indeed when compared with the figures for British emigration before the war.

The chief centres of Japanese settlement, as the result of previous migration, are: China, the United States, Hawaii, and Brazil. In Hawaii, indeed, there are some 130,000 Japanese; in Brazil, some 60,000. Other places of past settlement are: Peru, 12,000; Canada, 20,000; Philippines, 12,000 or so; Australia, 3,752 in 1926. Perhaps the most unexpected feature of this list is the great number in Hawaii and in Brazil.

It is clear that, even if the net emigration from Japan were to amount to ten times its present volume, it would still be very far from relieving the congestion of population in the mother country. It is difficult to imagine that the emigration is likely to attain such proportions; but if it were to, in comparatively near times, the pressure would only be reduced, temporarily, in a small degree, and it would be almost immediately restored, and, indeed, would probably almost at once increase again. Looked at in this light, emigration is a poor palliative and no real remedy, so long as the population continues to increase at its present very high rate. But it may be as well to look for a moment at the tendencies and conditions of Japanese emigration in the past. The largest outflow in the past has been to China, and after China

to Hawaii and to California. In the latter State there were 72,000 Japanese in 1920, their numbers having nearly doubled during the decade 1910–20. But, before the end of this period, in fact in 1911, the Japanese Government agreed to limit the emigration to America. Even at its height, a large proportion of emigrants ultimately returned to Japan.

The situation with regard to Hawaii is interesting. In 1927, 132,000 out of a total estimated population of 330,000 were Japanese, that is, 40 per cent. Of these a large proportion were born in Hawaii; in 1910 it was ascertained that about 80,000 of the Japanese living in Hawaii were born abroad, i.e. not in Japan. The Japanese in Hawaii have a very high birth-rate, and the islands evidently suit them in climate and general circumstances, although the situation is definitely tropical, with a tropical oceanic climate. In comparing the evident suitability of the conditions in American Hawaii with those in Japanese Formosa (Taiwan), one is struck by the fact that, although the Japanese in the latter island are living in one of their own possessions, their numbers are relatively small, and the island seems to have no great attraction for Japanese emigrants. One reason, no doubt, is the fact that there is a large Chinese population. The total population, in Formosa, of all races, as reported after the census of October 1930, was 4,594,161. It may be supposed that the reasons that militate against Japanese emigration to Formosa are, in the first place, the existence of a large Chinese population with a lower standard of living than the Japanese; and secondly, perhaps, the rather accentuated tropical climate; and thirdly, the native problem. The total number of Japanese in Formosa is probably under 200,000. Japanese emigration to Formosa will depend, at least to some extent, upon the settlement of the head-hunting problem.

Towards the other end of the climatic scale we have the Japanese possession of Saghalien, or Karafuto, south of latitude 50°, an inhospitable land, not very attractive to emigrants. The Japanese portion is only some 10,000 square miles in area, and in any case does not give much scope for emigration. The population of Japanese Saghalien is increasing rapidly, however; according to the census of 1925 it was 203,754, and according to that of 1930 it was 295,187, a somewhat remarkable increase.

And, finally, we come to Korea (Chosen) of which the population in October 1925 was 19,522,945, and in October 1930 was

21,057,969. This gives an absolute increase of 1,525,024, and shows an average annual increase of 1·57 per cent., which is almost exactly the same as that of Japan proper, and may be compared with the annual rate of increase of Japan proper between the years 1881 and 1920, which was 1·1. The area of Korea is about 86,000 square miles, so that the density is some 242 per square mile—not much more than half that of Japan proper.

As has been stated above, the circumstances of Great Britain, Italy, and Japan have some similarity, and the population situation in the three countries has attracted a good deal of attention. Great Britain is saturated, and over-saturated, with people. Italy is in not quite such a bad state. And as to Japan, it would appear that, in the opinion of those qualified to judge, a point is rapidly being approached at which the density of population will have a bad effect on the standard of living. That standard is not a high one from a West European point of view. It does not look as if the colonization of Japanese possessions would be likely to relieve the pressure, partly because there is no great tendency for the Japanese to colonize—it has been noted that more Koreans go to Japan than Japanese to Korea. As to emigration to foreign lands, for various reasons this is quite negligible at the present time. Some writers have kindly offered Japan the possession of certain tropical lands which are not theirs to offer, notably the islands in the western Pacific, Borneo, Celebes, New Guinea, and Sumatra. But, apart from the fact that these territories belong to other Powers, it is by no means certain that the Japanese would emigrate to such tropical lands, or would do more than administer them. As to emigration to lands already in occupation by European races, Professor E. M. East has remarked: "The people of Australia, South Africa, and California have spoken in no uncertain terms. . . . They wish to avoid the crushing competition of peoples accustomed to toiling sixteen hours a day." What then is the outlook as regards the population of Japan? It continues to increase at an even higher rate than formerly; there is no evidence of a tendency to reduce the rate of increase; some relief may be found in the more dense occupation of Hokkaido and Saghalien, and it is possible that the pressure may induce a more serious migration to Korea and Formosa, and even emigration to Manchuria. But it does not seem likely that much relief will be found in these directions. Something is to be gained by the cultivation of the remaining land unutilized in Japan proper,

but it is believed that most of this is of indifferent quality. Already much food is imported. No doubt there will be a further expansion of manufactures; already, in 1924, there were about 2 million people in Japan proper employed in factories, and the numbers so employed were increasing at the rate of some 75,000 a year, so that, if the same rate has continued, there would now (1932) be about $2\frac{1}{2}$ millions. But since 1925 the population has increased by more than 5 millions, so that the relief is smothered.

Mr. H. L. Wilkinson (*World's Population Problems and a White Australia*, 1931) remarks: "The problem of each year providing for a million more people in Japan is still unsolved, and it becomes more difficult every year as opportunities for absorbing the additional population within Japan are used up, and competition in international trade restricts exports of manufactures." He goes on to say that the Japanese have made every reasonable effort to develop the natural resources within their country. Dr. Shiroski Nasu, of the Imperial University of Tokyo, quoted by Wilkinson, said, in 1927, that the standard of living had kept pace with the population, but he added: "The natural resources have been used almost to the utmost extent possible under the existing economic regime, and it will be wellnigh impossible to support any added population."

But the *Japan Year Book* for 1930 seems cheerfully to contemplate still larger numbers, for it states that assuming that the increase was at the rate of 1·2 per cent. per annum, the total in 1935 would be 67·275; in 1945, 75·758; and in 1965, 108·821 millions. But the rate of growth is, as a fact, larger than that assumed, being now (1932) about 1·6 per cent. per annum.

Some little time ago Mr. Harold Cox remarked that: "The Island Empire of Japan has become a great World Power. She is rapidly expanding her activities in almost every direction. Unfortunately the population is growing at a pace that must to some extent threaten adjoining countries."

Mr. W. R. Crocker (*The Japanese Population Problem*, 1931) suggests that: "The drawing off of some 50,000 to 100,000 persons each year under an emigration scheme might ensure the stability of Japanese society until the time comes when the population becomes stationary." Now, let us see what kind of relief this might bring, and let us assume—a considerable assumption—that the full benefit of this "drawing off" is experienced. Then, since the population was at the end of 1932 about 66·4 millions, at the

end of 1933 it will be about 67·3 millions; and if we draw off 100,000, we should reduce the numbers from 67·3 to 67·2, a reduction of 1 in 673, and we may picture the pressure as being reduced in the same proportion. This is not much of a relief!

Let me now quote the Tokyo correspondent of *The Times*, who, writing in July 1931, said that at the present rate of increase "Japan will have a population of 100,000,000 thirty years from now, and will be the third largest Great Power . . . assuming a continuance of present tendencies, the Japanese birth-rate rising, and that of Europe falling, the world of 1960 may be one in which the three single modern nations strongest in man power are the United States, Russia, and Japan." Later on in the article he points out that the Japanese do not emigrate. "Even when emigration into California and the Pacific States of America was at its height, the number of Japanese emigrants never exceeded 14,000 a year, a negligible figure when compared with the annual increase." In the second volume of *International Migrations*, edited by Mr. W. F. Willcox, the chapter dealing with Japanese migration was written by Mr. Yamato Ichihashi, who says: "Of late . . . both the Government and the thinking public in Japan have been agitated over the problem of population, and the Government has instituted a Commission of Population and Conservation." He points out that Australia and Hawaii are closed fields for Japanese emigration, and that the Philippines and Mexico will not attract such emigration, nor will Asiatic Russia. But he thinks well of Brazil. Broadly, however, he regards emigration as no solution of the difficulty.

Another writer, M. Étienne Dennery, in a suggestive book entitled *Asia's Teeming Millions*, looks upon the Japanese as rather colonial administrators than colonists.

It may not be out of place to quote a few remarks from the Tokyo correspondent of the *North China Herald*, written in 1931: "It is depressingly clear that, inasmuch as Japan cannot support the population of 1931 on the agriculture and industry of to-day, she must contrive a large expansion of her total resources for the maintenance of the new millions which coming years will add . . . and no reform in methods of production can cure even a part of the distress which besets rural Japan without driving an ever-increasing number of rural folks into the cities. But where . . . are the towns to find means to support the new influx? The

development of home resources . . . must be paid for by a great increase of exports. Japanese publicists utter a warning that unless there is a guaranteed outlet for 50,000 to 100,000 people by emigration each year for the next generation, a social collapse might occur. Where are they to go? . . . the Japanese population problem has an international aspect which makes it one of the most urgent issues in the Pacific."

Mr. H. G. Wells has recently called attention to the same question. He says: "In Japan, population which had been practically stationary for a century (between 1723 and 1846) at about 29 millions, leapt up with the extensive adoption of European methods of production to its present congestion of 60 million. Japan is now, as Carr-Saunders has pointed out, in practically the same phase as Great Britain in 1875, and there is no reason to suppose she will not presently follow the other modernized countries towards a reproductive arrest."

The Bishop of Birmingham has remarked: "A wholly new danger is upon us. There must be a limitation of the birth-rate, or over-population will become disastrous. Those countries, like Italy, Southern Ireland, and Japan, which refuse to have population checks, are a menace to the peace of the world."

And, finally, the Tokyo correspondent of *The Times*, in the issue of December 1, 1932, reports: "The domestic situation cannot be ignored. The farmers are faced with insolvency, remotely because agriculture in Japan is over-manned and seems to have entered the phase of diminishing returns, immediately by the calamitous fall in the price of raw silk. The young men who graduate from the universities and technical colleges find that their hard-won diplomas no longer procure them employment. . . ."

INDIA

The latest census, that of 1931, has revealed an enormous increase in the population of India. The total has risen from slightly under 319 millions in 1921 to 352·8 millions.

The following are the results, to the nearest million, of the last four censuses for the whole of India, both British India and the Indian States:—

Year 1901	294 millions
,, 1911	315 ,,
,, 1921	319 ,,
,, 1931	353 ,,

As regards density of population, the area of the whole of the Indian Empire is 1,805,332 square miles, so that the density per square mile is now 194. Burma is included in the totals given above. In 1921 Burma had a population of 13·212 millions. In 1931 the number was 14·647 millions.

The rates of increase have varied greatly. According to the *India Year Book*, "The increase during the 49 years 1872–1921 was about 54 millions, or 20 per cent." The average annual increase during that period was therefore about 0·4 per cent. The rate between 1911 and 1921 was about 0·12 per cent. per annum; and if we take the last 30 years the rate is 0·62. But the rate during the last decade is 10·2, or over 1 per cent. per annum. The absolute increase is 33 millions, "after a decade comparatively free from pestilence and famine." The density of population in British India is higher than in the Indian States.

It is very often said that India is not a country, but a collection of countries, a sub-continent, with great variety of races, religions, climates, and natural conditions, and that there is no real cultural unity. But however true this may have been in the past, it is less true to-day. A unifying process has been at work for many a year. Moreover, even in the past, there were only two predominant religions. It is true that there are many languages, but even as regards this point English and Hindustani will serve over most of the Peninsula. Culturally there is no very great difference between one part of India and another, Burma being always excepted. The chief agent in unifying India has, of course, been the British domination, that is the chief agent in recent times: unity of rule and increased facilities for intercommunication have very largely made India one country. But to this statement there is the exception of Burma.

Burma is not geographically a part of India, but of Indo-China. It is separated from India by a formidable mountain region. The Burmese are racially distinct from any Indian people, and are most allied to the Tibetans. Their religion, although it originated in India, has practically no adherents there now. The social customs of the Burmese are widely different from those of the natives of India. The Burman mentality finds little counterpart in India. These facts, as we all know, may perhaps be recognized politically. So we shall be quite justified in dealing with India proper separately from Burma, though it must be admitted that there are a million Indians in Burma.

India without Burma had, in 1931, a population of 338 millions, and an area of 1,571,625 square miles; so that the density of population per square mile was 215. This figure, which differs materially from that which results from including Burma, is the correct one to accept. Incidentally the figure shows how under-populated Burma is in comparison with India. The density, per square mile, of the population of Burma, according to the census of 1931, was 63. The Indian density of 215 may be compared with the density in Japan, 440, and in England and Wales, 685.

The natural rate of increase of population, that is, the birth-rate minus the death-rate, is of the order, just now, in India of 1 per cent. per annum, and the total increase is the natural increase minus the loss by migration. Let us look a little into this question of migration.

The book on *International Migration*, above noted, gives the statistics of Indian emigration. It states that "the Government of India assumed from the beginning the rôle of protector of East Indian emigrants," and outlines the various Acts dealing with the matter, from 1839 onward. It is stated that, "viewed comprehensively, Indian emigration for inter-continental destinations shows an upward trend from 1842 to 1918. . . . The figures mounted in an irregular fashion until in 1858 the peak was reached with 45,838 emigrants." Between 1870 and the Great War we may picture the average departures as of the order of 18,000, with considerable variations. This inter-continental movement —that is to continents other than Asia—was then numerically insignificant. The chief destinations were: the West Indies, including the French West Indies, British Guiana, Fiji, Mauritius, Réunion, South Africa, and East Africa. The emigration was almost entirely of the labouring class, and, in the cases of the West Indies and Mauritius, was directed to the sugar estates. This form of indentured labour "lent itself only too readily to grave abuses," so that in 1916 the Government of India informed the Secretary of State for India that "the time had come for His Majesty's Government to assent to a total abolition of the system of indentured labour in the four British Colonies where it still prevailed and in Surinam (Dutch Guiana)."

The principal results of this emigration are that there are in British Guiana about 125,000 Indians resident in the colony, nearly a third of the population. In Fiji there are about 60,000 out of a total population of 160,000; in Mauritius, in 1924, there

were 255,000; in South Africa, in 1921, there were over 165,000; in East Africa there are about 25,000. Altogether, in continents other than Asia, there must be about three-quarters of a million Indians, a relatively insignificant number. Under the Union Immigrants Act, 1913, Asiatics, with the exception of wives and children of domiciled relatives, are prohibited from entering the South African Union. Nowadays practically no Indian labourers emigrate outside Asia.

In Asia, the chief countries to which Indians emigrate are Ceylon and the Malay Peninsula. According to the 1921 census, there were over 1,400,000 persons of Indian extraction inhabiting Ceylon, and the Indian population of the Malay Peninsula was 470,000 in 1924. There are, therefore, more than $2\frac{1}{2}$ millions of Indians domiciled outside of India.

The net emigration to Ceylon, from 1911 to 1923, averaged about 17,000 a year. It is difficult to disentangle the figures for the Malay Peninsula, but it would appear that the net emigration to that country is of the order of 30,000 per annum.

The net emigration from India is now small, and can afford little relief to population pressure.

And now let us consider the effect of population conditions on the natives of India. Professor Carr-Saunders (*The Population Problem*, p. 277) says that India is in an intermediate stage as regards the process of population growth; it is at a point where the population is controlled by disease and disease only. "That which is common to these races, where over-population is suspected, is the absence of hope and fear alike, of ambition and a standard of living; they are contented to subsist on what will just support life." He quotes P. K. Wattal to the effect that "in Europe 250 persons to the square mile is thought to be the limit of density where agriculture is practised, whereas in India from four to five times that number in many places find their support on an area of this size." He finds the explanation ". . . in the lowness of the standard of living."

At the World Population Conference, which was held at Geneva in 1927, Dr. R. K. Das said: "The fundamental cause of India's poverty is the lack of growth in productive power in proportion to the increase of population within a century or more. . . . There are several factors which have contributed to the low productive power or industrial inefficiency in India, such as starvation and disease, illiteracy and ignorance, social customs, industrial

systems, and political conditions." And again: "By far the major part of Indian man-power is underfed, diseased, illiterate, and unskilled. . . . Of the arable land about 55 per cent. is already in use, and any intensity in cultivation would operate only under the condition of diminishing returns . . . the appropriation of the other 45 per cent. of the arable land would require irrigation, drainage, fertilization, acclimatization, and other scientific treatment."

He also says that: "Both the insufficiency of resources and the inefficiency to develop them have made India one of the most over-populated countries of the world. . . . The *per capita* food supply is much less than one-third that in the United States. . . . Even with plain living and high thinking, which has been the ideal of Hindoo civilization, one is inevitably driven to the conclusion that there exists in India to-day, under the present state of her industrial efficiency, double the size of the population which could live with a moderate degree of opportunity for moral and material development." A gloomy picture.

Wilkinson (*World's Population Problems and a White Australia*, 1931), who quotes Dr. Das, and accepts generally the picture as drawn by the latter, draws a somewhat different moral: "Agricultural production in India is capable of sufficient development to give both work and food to nearly double the present population . . . the continuation of a strong and efficient government is necessary to guarantee the money needed for developing agriculture fast enough to absorb the annual rate of increase of this population." With regard to emigration he remarks: "There is little net emigration, and the Indian people have apparently no wish to leave their own country in order to acquire and settle on land in other parts of the world; and so far as one can see into the future, the desire of Indians for emigration is not likely to increase."

We may, then, sum up the situation as regards India as follows: the present population of India, including the Indian States, but excluding Burma, is about 338 millions; the rate of increase is variable, but just now is 1 per cent. per annum, and the absolute increase per annum is about 3·2 millions. The people of India generally have a very low standard of living, and, according to some authorities, are in the main under-fed and have little opportunity of improving their general standard of life. About 55 per cent. of the available land is devoted to agriculture, and some

help is to be expected from further agricultural development. Both the birth-rate and the death-rate are high, and no doubt the death-rate will remain high so long as the present insanitary customs continue. If these were to be amended, and the death-rate were, in consequence, to diminish, the population would increase more rapidly and the pressure of population would increase also. Warren Thompson (*Danger Spots in World Population*, 1929, p. 148) remarks that: "There is not much doubt that the situation in India can be somewhat changed—we hesitate to say relieved—by the better utilization of the land." He adds: "As long as the birth-rate is 15 to 20 per thousand higher than a reasonable death-rate, there can be little or no permanent improvement in the standard of life in India." Professor E. M. East, of Harvard, remarks (*Mankind at the Crossroads*, 1925, p. 89) that in British India, 200 million acres are now in use, and some 150 million acres of less valuable land could be cropped later. "The country is an agricultural country wholly and solely." He also says, "Without England . . . (India) would have had less than half of the population she now possesses, and her people would have been the world's choicest examples of a hopeless existence." And again: "English brains have made a new India in 50 years. Famine-stricken, pestilence-smitten, cobra-bitten India has been given a new lease of life, . . . a thoroughly modern department of agriculture is seeing to it that Indian farming is progressing in a most marvellous manner." With regard to this, another writer says: "If better methods of cultivation are adopted, they will but enable more people to live on the same land at customary standards . . . there is no real relief for such a country save the restriction of births, although emigration on a large scale would give temporary relief to certain areas."

It is sometimes suggested by well-intentioned people that if there is an unduly large population in India, relief could be found by causing large numbers of Indians to emigrate to East Africa. This sort of ready solution has a certain plausibility until it is realized that emigration on any likely scale would have the most trivial effect on the enormous reservoir of population that India represents. And, whilst it would have a trivial effect on India, it would have an effect anything but trivial on Africa. Some go so far as to contemplate with approval the eventual creation of a mixed Indo-African breed. With regard to this particular point it may be noted that it is not very likely that any considerable

numbers of the best Indian stocks would emigrate. Those who wish well to the native African would hesitate to countenance such an experiment on a large scale. The actual number of Indians in East Africa at the present time is, as before mentioned, small —in fact, something like 25,000. And it is not unreasonable to remark that already no less than one-sixth of the human race is Indian, and that other races should have consideration extended to them. It only remains to add that at the present time about the same percentage is Chinese. Indians and Chinese together account for nearly one-third of humanity.

Let us look a little more closely into this suggestion of relieving the population pressure in India by drawing off, say, 50,000 a year into British East Africa. The last census of India, which was taken on the night of February 26, 1931, gave a total for India, excluding Burma, of 338·2 millions. The increase for India proper, since the census of 1921, was 32 millions, or 3·2 millions each year.

Suppose, now, that it is intended to export 50,000 Indians during the year 1933, what sort of relief will there be? Well, the population at the end of that year, if it increases at the same rate as in the last decade, will be about 347 millions, and if from this total we take 50,000, we reduce the total in proportion of 347·00 to 346·95, that is, in the proportion of 6,940 to 6,939, and we shall have eased the pressure by about 1 part in 7 thousand —a negligible amount. It is difficult to see how a policy of emigration can have any seriously beneficial effect upon the state of overpopulation which most students of the subject think that India suffers from.

If emigration cannot solve the problem, let us turn to other suggested remedies. The first of these is, of course, the extension of the area of cultivated land. We have seen that only about 55 per cent. of possible land is in use, though this includes all the best land. In this connection let me quote Professor Julian Huxley, who, writing in the *Contemporary Review* for July 1931, remarked: "The Indian mortality rate could doubtless be reduced by half, but what would you do with the increased population? Even if you bring huge areas of arid Indian land under irrigation and cultivation, it is only a matter of a generation or so before the now vacant space will be overrun by new population on the same low level of prosperity, health, and education as the old. Have you done any good by causing more babies to live and so

creating greater population pressure, or by opening up new land to be filled at once by the human flood?"

The third method of dealing with the problem, which has been proposed, is an increasing industrialization of India. Dr. R. K. Das (*Proceedings, World Population Conference*, 1917, p. 116) has said with reference to this matter: "Machinery and mechanical power have up to this time been applied to only an insignificant part of her industrial life. Nor are there large social savings which would be transformed into working capital in the immediate future." Mr. W. S. Thompson, of Miami University, in his *Danger Spots in World Population*, 1929, p. 155, devotes some pages to the suggested development of factory industry in India. He sums up against the idea: "It does not seem reasonable . . . to expect that a country like India can absorb any of its increase in population into the machine industries for a long time to come. The development of factory industry will be extremely slow at best, and may even receive a set-back from time to time. . . . The economic organization of a people is just as much a part of its civilization as its literature or its art . . . the outsider is seldom in a position to understand and appreciate the values that a people finds in its own mode of life." I quote these wise words with all the more pleasure in that most of us will have no hesitation in rejecting Mr. Thompson's panacea of emigration. I believe that most people who have thought about the matter will look upon emigration as an impossible solution of India's population difficulties, for the reasons that on any conceivable scale it would be a relief of minute proportions in comparison with the mass to be relieved; that there is no security that the flood would not in a short time fill up to the old level; that the Indians have shown no wish to emigrate in any numbers; that the field for emigration most usually mentioned in this connection, namely, East Africa, is really not available, unless we are prepared to do an immense racial injury to the natives of Africa. Let us therefore put aside the idea that emigration can be a cure for the Indian congestion. *The* cure is a reduction of the birth-rate, combined with the improvement of agriculture.

CONCLUSION

And this leads us to the conclusion of the whole matter. When we consider those masses of humanity, in England, Japan, China, India, or elsewhere on this world's surface, we cannot help asking

ourselves: What general view should a statesman hold of the purpose of human life? Statesmen guide the destinies of mankind; in what direction, and for what end? Should a philosopher-statesman prefer an India of 350 millions, of short-lived, underfed, uncultured people, or an India of half that number, but fitter in mind and body; with greater opportunities for self-development and expression? In the words of The Shorter Catechism, "What is the chief end of man?"

LA POPULATION BELGE

Par le Rev. Père VALÈRE FALLON, s.j.

L'accroissement continu qui amena la population belge de moins de 4 millions à plus de 8 millions d'habitants en l'espace d'un siècle, a créé chez la plupart de nos contemporains l'illusion que cet accroissement se poursuivrait indéfiniment, ou que du moins le chiffre actuellement atteint serait aisément maintenu.

Les uns s'en félicitent, parce qu'ils voient dans l'abondance de la population le premier élément de la vitalité, de la prospérité et de la grandeur d'un peuple. Les autres, imbus des théories malthusiennes, s'en inquiètent. Mais les uns et les autres semblent ignorer que nous sommes à la veille d'un renversement qui entraînera le pays à une irrémédiable décadence.

Si les conditions démographiques actuelles persistent, la Belgique retombera, avant un siècle, au niveau d'où elle était partie. De 3.735.000 habitants en 1830, elle a atteint 8.129.824 habitants en 1930; mais, si les facteurs qui influent sur le phénomène restent ce qu'ils sont en ce moment—même sans aucune aggravation—la population belge retombera, dans un siècle d'ici, à 3.700.000 habitants environ.

Cette perspective d'un peuple qui dépérit, d'une nation qui s'atrophie, d'une race qui s'épuise, est assez pénible et assez angoissante pour qu'il soit superflu d'y insister.

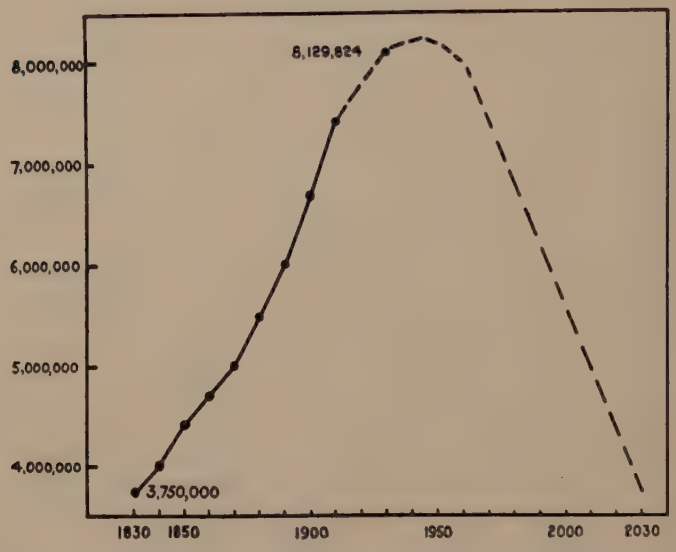
Ce que nous voudrions, c'est fournir les données essentielles du problème à ceux qui désirent se rendre compte par eux-mêmes de ce qui se prépare.

Nous présenterons d'abord la courbe de la population belge telle qu'elle résulte des statistiques pour la période de 1830 à 1930, et telle qu'elle est à prévoir d'après les calculs les plus consciencieux pour la période de 1930 à 2030, en supposant que les conditions restent les mêmes.

Puis nous donnerons les statistiques et les courbes du nombre annuel des naissances et du taux de natalité, du nombre annuel des mariages et du taux de nuptialité, du nombre annuel des naissances par mariage, du taux de mortalité, et enfin une idée de la structure de la population par âges.

De l'examen de ces données ressortira la preuve du mal que nous signalons. Il ne nous restera alors qu'à indiquer les remèdes; car il y a des remèdes et il dépend du pays de se les appliquer.

COURBE DE LA POPULATION BELGE, DE 1830 À 1930 PUIS À 2030 DE DIX EN DIX ANS



Pour 1830, le chiffre est celui des territoires restés belges après le traité de 1839 qui nous fit perdre le Grand-Duché de Luxembourg et le Limbourg hollandais.

A partir de 1919, on a incorporé la population des cantons rédimés de Malmédy et d'Eupen.

Dans la première partie de la courbe, les chiffres sont exacts de dix en dix ans; pour les intervalles la courbe est schématisée. On a omis le chiffre relevé en 1920, en raison des perturbations accidentelles dues à la guerre, et on a indiqué la marche moyenne de la population de 1910 à 1930.

A partir de 1931, la courbe indique la marche probable jusqu'en 2030, si les conditions actuelles se maintiennent: accroissement ralenti pendant une vingtaine d'années, sommet atteint au chiffre d'environ 8.500.000; puis chute qui ira s'accélérant pour aboutir à 3.700.000 environ en 2030. Le détail n'a pas d'importance à notre point de vue; c'est l'aboutissement qui importe.

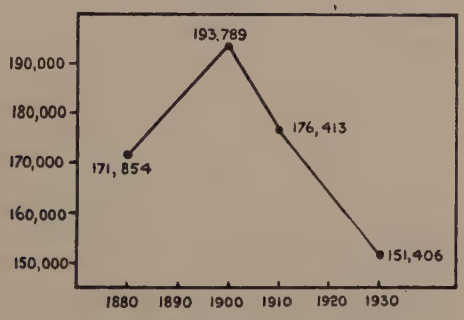
Pour les prévisions relatives à la période de 1930–2030, nous nous sommes basés principalement sur le mémoire que Melle Vulhopp, docteur en sciences politiques et sociales, vient de publier et dont la Société Scientifique de Bruxelles ainsi que l'Association belge pour l'Etude scientifique des Problèmes de la Population ont reconnu la haute valeur. On en trouvera le texte

intégral dans les Annales de la Société Scientifique de Bruxelles, Ve Section, Sciences Economiques (janv.–mars 1932).

L'exposé et la justification de la méthode suivie dépasseraient le cadre de cet article; mais, si surprenante qu'en soit la conclusion, elle n'est malheureusement que trop vraisemblable pour quiconque réfléchit à ce qui s'est passé dans ces cinquante dernières années.

Les indices précurseurs de la chute se sont multipliés, en effet, depuis 1880 et ils se sont aggravés surtout depuis 1900.

Le nombre annuel des naissances atteignit 193.789 en 1900; il monta même à 200.077 en 1901; ce fut le sommet. Mais, depuis lors, il fléchit rapidement: en 1910, il était de 176,413; omettons 1920, en raison des circonstances exceptionnelles de l'après-guerre; en 1930, le nombre des naissances n'était plus que de 151.406. Soit 42.383 naissances en moins qu'en 1900. La baisse avait donc été de 22 % en trente ans.



COURBE DU TAUX DE NATALITÉ DE 1880 À 1930

(Nombre de naissances vivantes par 10.000 habitants) *d'année en année.* (On a omis la période de 1914 à 1921.)

Comme on le voit ci-dessus, *le coefficient de natalité* (nombre annuel des naissances par 10.000 habitants) fut de:

314 en 1881,		Omettons la période de la guerre,
294 en 1901,		204 en 1923,
224 en 1913,	et	181 en 1929.

Un tassement semble s'opérer depuis cette date; on voit même une légère reprise en 1930 (186).

La baisse du taux de natalité s'est donc poursuivie depuis cinquante ans déjà; elle s'est précipitée depuis 1901. Elle a été au total de 42 %.

Si encore cette baisse du nombre annuel des naissances et du taux de natalité résultait d'une diminution du nombre des mariages et du taux de nuptialité, on apercevrait un remède aisé dans la multiplication des mariages. Mais c'est le contraire qui est arrivé. Le nombre annuel des mariages a été en notable augmentation. Il fut de:

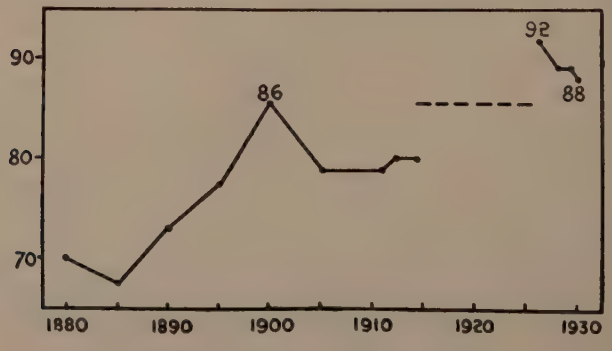
39.926 en 1880	58.776 en 1910
44.596 en 1890	omettons 1920
57.711 en 1900	71.624 en 1930

Donc le nombre annuel des mariages a presque doublé de 1880 à 1930.

Quant au *taux ou coefficient de nuptialité* (nombre de mariages par 10.000 habitants), il était de 70, en 1880; 76, en 1890; 86, en 1900; 78, en 1910; 92, en 1927; 88, en 1930.

COURBE DU TAUX DE NUPTIALITÉ DE 1880 À 1930

de 5 *en* 5 *ans:* (Nombre de mariages par 10.000 hab.)
Pour la période de 1914 à 1925, on a indiqué la moyenne.



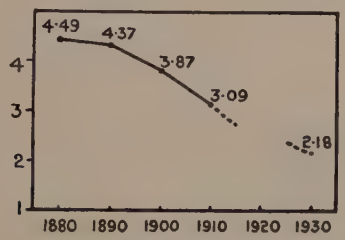
Le taux de nuptialité a donc passé de 70 à 88, entre 1880 et 1930; augmentation de 26 %.

Cette augmentation du nombre et du taux des mariages aurait dû s'accompagner d'un accroissement parallèle du nombre des naissances. Or, si nous comparons les années 1900 et 1930, nous trouvons 24 % de mariages en plus et, malgré cela, 14 % de naissances en moins!

C'est que le nombre de naissances par mariage décroît de façon étonnante.

COURBE DU NOMBRE MOYEN DE NAISSANCES VIVANTES PAR MARIAGE ANNÉES 1880–1900–1910–1930

(On a divisé le nombre des naissances des années 1880, 1890, 1900, 1910 et 1930, par le nombre annuel moyen des mariages pendant les dix années précédentes; pour 1930, on a divisé par le nombre moyen des neuf années précédentes, pour écarter l'erreur à résulter du nombre exceptionnel de mariages en 1920.)



Donc, en 1880, on avait en moyenne, 4,49 naissances par mariage;
en 1900, on n'en avait plus que 3,87;
et en 1930, on tombait à 2,18.
La chute dépasse 50 %.

Ce taux de 2,18 naissances par mariage révèle, mieux que tout autre phénomène, l'extrême gravité du mal qui ronge notre population. A ce rythme, il est évident que la population doit bientôt décroître et, si un redressement ne se produit, disparaître. En effet, les 2,18 naissances par mariage ne suffisent pas même à remplacer les parents. D'après la statistique des décès par âges pour la dernière année connue (1928), 2,18 naissances ne donnent que 1,61 adultes de 30 ans. Donc 2,18 naissances ne donnent pas même de quoi remplacer les parents; il manque 0,57 par mariage. Et il faudrait, en outre, pouvoir au remplacement des habitants qui meurent célibataires.

Pour maintenir la population, il faudrait environ 3 naissances par mariage, au lieu de 2,18. Au taux actuel, la diminution est fatale; elle est déjà virtuellement commencée; elle sera rapide.

Mais, dira-t-on, comment la population a-t-elle continué à s'accroître de 1901 à 1930, tandis que les naissances diminuaient?

C'est d'abord que, jusqu'en 1901, le nombre annuel des naissances avait été en progressant. Or beaucoup des habitants nés entre 1860 et 1901 sont encore en vie; ils ont maintenant de 32 à 72 ans; ils comptent encore dans le total.

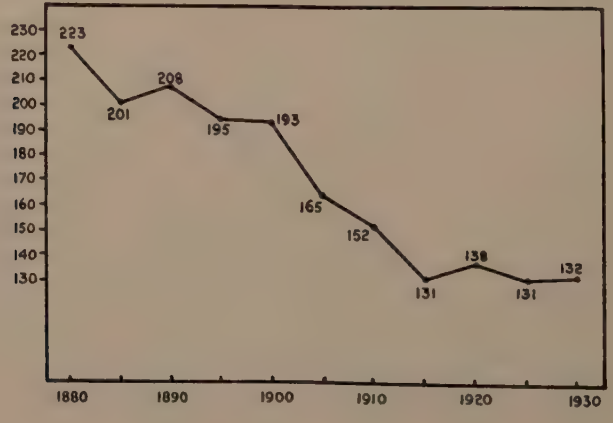
D'autre part, cette explication nous montre ce qu'il y a de précaire dans la situation actuelle; d'ici à une vingtaine d'années, un maximum sera atteint puis le renversement se produira; les forts contingents des années 1880 à 1901 auront disparu et ils auront été remplacés, d'année en année, par des contingents de plus en plus faibles.

Une autre circonstance a tempéré les effets du fléchissement de la natalité: la mortalité a diminué par l'heureux effet des progrès de la médecine, de l'hygiène et notamment des soins donnés à la première enfance.

Le taux de mortalité, c'est-à-dire le nombre de décès par 10.000 habitants, a suivi une baisse parallèle à celle du taux de natalité.

En 1880, on comptait 223 décès par 10.000 habitants;
en 1900, on en comptait 193;
en 1930, on en comptait 132.
La baisse fut donc de 41 %.

COURBE DU TAUX DE MORTALITÉ DE 1880 À 1920 DE 5 EN 5 ANS



L'illusion que se font tant de personnes sur la situation réelle et sur l'avenir de notre population, vient surtout de cette diminution du nombre annuel des décès. Illusion, disons-nous, car la baisse de la mortalité ne se poursuivra pas indéfiniment. La vie peut s'allonger de quelques années; elle a quand même un terme. La mort peut retarder ses coups; elle finit toujours par les porter. Elle ne nous donne qu'un répit.

La courbe du taux de mortalité marque déjà un palier dont le prolongement devient inquiétant. En 1915, le taux était de 131; en 1925, il était encore de 131; en 1930, il se relevait même un peu et marquait 132.

D'où vient cet arrêt? Les progrès de la médecine et de l'hygiène seraient-ils épuisés? Ou cesserait-on de les appliquer avec le même soin? Bien au contraire; les progrès continuent et, depuis 1915, on a multiplié chez nous les cliniques, les dispensaires, les maternités, les sanatoria, les colonies de grand air, les mutualités qui assurent à bon compte les soins médicaux et pharmaceutiques; on a créé des écoles d'infirmières, des équipes d'infirmières visiteuses; l'Œuvre nationale de l'Enfance travaille activement; il y a des médecins partout et l'automobile les met rapidement à portée des malades.

Alors? L'explication est malheureusement trop claire. Les générations nées de 1860 à 1901 ont atteint l'âge mûr et même la vieillesse; elles ont aujourd'hui de 30 à 70 ans; chacune d'elles était nombreuse; maintenant, elles paient chaque année un large tribut à la mort. Et depuis 1901, par qui sont-elles remplacées? Par des générations de plus en plus restreintes, qui (sans parler de la période exceptionnelle de la guerre) sont descendues jusqu'à 145.275 naissances en 1927, soit 54.802 de moins qu'en 1901.

En deux mots: plus de viellards et moins d'enfants.

Chaque année, plus de disparus et moins de nouveaux venus.

La mort l'emportera bientôt sur la vie.

* * * * *

La structure d'une population—c'est-à-dire la proportion d'enfants, d'adultes, de vieillards qu'elle contient—mérite autant d'attention que le nombre de ses membres. Or, si l'on compare la structure de la population belge, aujourd'hui et il y a trente ans, on se rend compte au premier regard d'un notable changement.

Nous n'avons pas encore les chiffres du recensement de 1930 et, d'autre part, les chiffres de 1920 ne peuvent pas être utilisés, les

événements exceptionnels de la guerre s'y faisant trop fortement sentir; il faut donc attendre pour pouvoir donner des précisions chiffrées. Mais il est certain que la publication du recensement de 1930 manifestera un accroissement notable de la proportion des vieillards.

La population belge vieillit rapidement.

Elle marche rapidement à la mort.

NOTESTEIN (FRANK W.). *The Decrease in Size of Families from 1890 to 1910.* 8 pp. Reprinted from the *Quarterly Bulletin of the Milbank Memorial Fund.* Vol. IX, No. 4, October 1931.

The fact that enumerations of population are concerned with the number of persons sometimes causes that other population unit—the family—to receive less attention than it deserves. The importance of the family is stressed in economic and social discussions, and changes in the incidence of the size of the family have important economic and social consequences. The author has examined data relating to this problem concerning families in different social strata in the United States, and concludes that his data indicate that large families were becoming increasingly scarce in both the urban and rural social classes of the native-born population even before 1910, and that their place was being taken by childless and one-child families in the cities, and by two- and three-child families in the rural areas.

PEARSON (DR. S. VERE). *Causes of Rural Depopulation.* 10 pp. Reprinted from the *Report of the International Geographical Congress,* Cambridge, July 1928.

Dr. Pearson discusses some of the economic tendencies to rural depopulation, the transfer to the towns, and concludes that the regime of property lies at the root of the maldistribution of population in a geographical area. The primary cause is the establishment of private property in land through the private appropriation of community-created land-rent. In the discussion following the reading of Dr. Pearson's paper, Dr. Fawcett expressed the opinion that one of the causes of rural depopulation was to be found in the mechanization of agriculture.

SYDENSTRICKER (EDGAR). *A Study of the Fertility of Native White Women in a Rural Area of Western New York.* 16 pp. Reprinted from the *Quarterly Bulletin of the Milbank Memorial Fund.* Vol. X, No. 1, January 1932.

This is a study of data concerning the births of children to married women in a small rural area in New York State, and a comparison of fertility of farmers' wives over a period 1900–1930. The author arrives at an interesting conclusion, that no significantly downward trend has occurred in the fertility-rate of wives of farmers of native stock in this typical rural area.

WILLCOX (WALTER F.). *Changes Since 1900 in the Fertility of Native White Wives.* 12 pp. Reprinted from the *Quarterly Bulletin of the Milbank Memorial Fund.* Vol. X, No. 3, July 1932.

This is a study of possible causes of the stable fertility-rate observed by Mr. Sydenstricker in the paper referred to above. The author cannot reconcile Mr. Sydenstricker's conclusions with his knowledge of changes in the fertility-rate generally, and examines the changes which have taken place between 1900 and 1930, for each state, in the fertility of native white wives. He finds the geographical distribution of the change in fertility points to a possible connection with the proportion of the population of foreign birth, and concludes that an important cause or possibly the main cause of the rising fertility noted by Mr. Sydenstricker has been the slow permeation of the class of native white women in the present century by American-born daughters of foreigners with the high fertility of their original stock.

SALLUME (XARIFA) AND NOTESTEIN (FRANK W.). *Trends in the Size of Families Completed Prior to 1910 in Various Social Classes.* 11 pp. Reprinted from the *American Journal of Sociology.* Vol. XXXVIII, No. 3, November 1932.

The authors have made a special tabulation of samples of the 1910 Census data relative to the occupation of the husband, the wife's age, and the number of children born. These data allow wives to be grouped according to rough social classes, according to age, and to examine the ratios of children born per 100 wives of specific age-groups and for different social classes. The following conclusions are arrived at: the size of the completed family for each social class was declining throughout the period covered, and this change in the size of the family reflects falling birth-rates of an earlier period. Fertility appears to have declined in the urban classes more rapidly than amongst rural classes, and more rapidly in "upper" classes than in "lower" classes of the social scale. These differences in rate of decline have led to increased differences in the fertility of these social classes.

PEARL (RAYMOND). *Contraception and Fertility in 2,000 Women.* 44 pp. Reprinted from *Human Biology.* September 1932.

One of the major problems of population is the study of the rate of recruitment of the population of a country. It is a commonplace fact that the birth-rate has been declining steadfastly in many countries over a long period. The causes of this decline are the matters of interest to workers in many different fields of research. One of the most easily asserted propositions at the present time is that birth control is and has been for many years the chief cause in the decline of the birth-rate. Can evidence be adduced to support this? At present an investigation is in progress in which an attempt is being made to find out how prevalent and how effective is the use of contraceptive methods. This paper is a preliminary report on the first 2,000 cases, of which details were obtained from patients in maternity wards in a number of hospitals in cities of the United States. No definite conclusions are attempted in this report, as it is expected that finally a much larger experience will be available. The data are collected from women undergoing parturition in the obstetric clinics of hospitals, and include details respecting economic status, age, number of pregnancies, colour, racial origin, use of contraceptive methods. Amongst these 2,000 cases there were 36 per cent. of the white women making some attempt to prevent conception, while 15 per cent. of the negro women of the group also made such attempts. The majority of the 2,000 cases come from the lower economic and social levels. The contraceptive methods practised by the group of married white women were accompanied by a reduction in the pregnancy-rate per person per unit time of about 20 per cent. below the rate in the comparable group of married white women not adopting any contraceptive methods. In the case of the negro married women the pregnancy-rate is actually *higher* amongst the group of women employing contraceptive devices than for the comparable group of women who do not employ such devices. In conclusion the author suggests that there may be reason for thinking that women practising contraception are innately more fertile than those who do not do so. The fuller report of the author on the whole body of evidence finally collected will be awaited with a great deal of interest.

TANDY (ELIZABETH CARPENTER). *Secular Changes in Mortality-Rates Connected with Certain Organ Systems.* 34 pp. Reprinted from *Human Biology.* December 1931.

This paper gives the results of an examination of the changes in mortality assignable to the Circulatory, Respiratory, Excretory, Alimentary, and Nervous Systems during the period 1910 to 1922, Urban and Rural Populations of the United States and those of England and Wales being compared. On the whole there appeared to be no important change in the mortality assigned to the first two causes, but on the other hand there was a marked decline in the mortality assignable to the Alimentary and Nervous Systems in all the groups of population considered.

YUAN (I-CHIN). *A Critique of Certain Earlier Work on the Inheritance of Duration of Life in Man.* 7 pp. Reprinted from the *Quarterly Review of Biology.* Vol. VII, No. 1, March 1932.

In this paper the author passes under critical review the work of Beeton and Pearson (1899) and Bell (1918) on longevity. These authors base their conclusions on evidence derived from genealogical material, and the writer of the paper described above considers that this material, as sample material, is open to criticism. He would be inclined to accept the general conclusion that a tendency to longevity is an inheritable character, but does not consider that the case was proved by the earlier writers owing to the peculiar nature of the evidence at their disposal at that time.

PEARL (RAYMOND). *The Influence of Density of Population upon Egg Production in Drosophila Melanogaster.* 28 pp. Reprinted from the *Journal of Experimental Zoology.* Vol. 63, No. 1, August 1932.

Professor Pearl is concerned with the effect of density of population on the number of progeny. In this paper he describes the results of experiments on the relationship between fecundity (number of eggs produced) and population density. He shows that as the density of population within a limited universe increases the rate of egg production per unit of time decreases. He shows also that the effect of population density is immediate in that when individual flies were placed under conditions of high and low density in alternate 24-hour periods, the rate of egg production was greater in the low-density periods than in the high-density periods. He is led to formulate in mathematical terms the change in egg-production-rate with increasing density, and finds that a mathematical expression which is also used to relate the mean free path of molecules to density in a gas will serve to describe his results.

ALPATOV (WLADIMIR WLADIMIROWICH). *Egg Production in Drosophila Melanogaster and Some Factors which Influence it.* 27 pp. Reprinted from the *Journal of Experimental Zoology.* Vol. 63, No. 1, August 1932.

Population growth, changes in fertility and fecundity are being observed experimentally, using Drosophila for this purpose. It is considered wise to find out what influence external factors of various kinds have on these vital matters. The author gives in this paper the results of certain observations. He finds that temperature during development of the flies has a pronounced influence on the time of the beginning of the reproductive period. The colder the temperature during development, the earlier the

egg production begins. Underfeeding reduces productivity, and a negative relationship is observed between duration of life and average egg production per day for the whole producing period.

WINSOR (CHARLES P.). *The Gompertz Curve as a Growth Curve.* 8 pp. Reprinted from the *Proceedings of the National Academy of Sciences.* January 1932.

WINSOR (CHARLES P.). *A Comparison of Certain Symmetrical Growth Curves.* 12 pp. Reprinted from the *Journal of the Washington Academy of Sciences.* Vol. 22, No. 4, February 1932.

The interesting problem of attempting to describe the growth of a population in time by means of mathematical formulae has long engaged the attention of many research workers. The author in the first paper makes a comparison between the Gompertz curve, which has long been used in actuarial science, and the Logistic curve, discussing the properties possessed by the mathematical expressions to which these curves correspond. In the second paper, he pays attention to other curves, in particular the integrated normal curve, again comparing these with the Logistic. The general conclusion is that within a fairly large portion of their lengths these various curves are very nearly identical, and that any one of them might reasonably well describe the changes with time which take place in a given population.

BAILY (JOSHUA L., JR.). *Some Data on Growth, Longevity, and Fecundity in Lymnaea Columella Say.* 22 pp. Reprinted from *Biologia Generalis,* Band VII, Lieferung 3 (Schlusslieferung). 1931.

The author herein describes the results of certain observations on the growth of snails. He finds that the changes in size of individuals with time may fairly be described by a logistic curve. He also has evidence to show that duration of life is inversely associated with maximum growth-rate, those snails growing at the quicker rate tending to live a shorter life. Egg production, he finds, is directly associated with limiting shell size and with duration of life.

BURGDÖRFER (FRIEDRICH). *Eugenik und Krieg.* The International Congress for Studies regarding Population Problems, Rome.

The author investigates three main questions. He considers first the effects of compulsory military service existing in pre-war Germany, in raising the age at marriage and spreading town outlook and habits among the rural population.

The second section deals with the direct effects of the Great War and analyses casualties and mortality rates. The significance of the loss lies in the fact that the greater proportion of the fatalities were among young, unmarried men. It is estimated that 70 per cent. of German youth was destroyed before it could pass on its hereditary qualities.

The last section considers the influence of the War on the birth-rate, by increasing the proportion of unmarried women and altering the age composition of those who were married. The author finds that one-seventh of decrease in births compared with pre-war rates is due to these changes in the structure of the population caused by the War.